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Fig. 1.—PIPE LINE FROM RESERVOIR TO POWER HOUSE.

Fig. 2.—MULE TEAM HAULING PIPE FOR THE PIPE LINE.

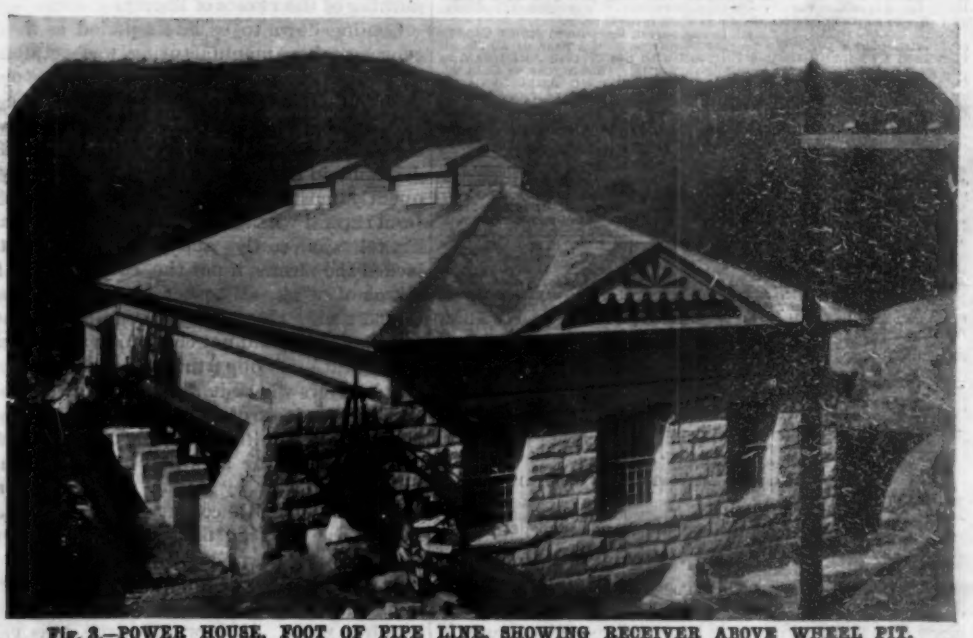

Fig. 3.—POWER HOUSE, FOOT OF PIPE LINE, SHOWING RECEIVER ABOVE WHEEL PIT.

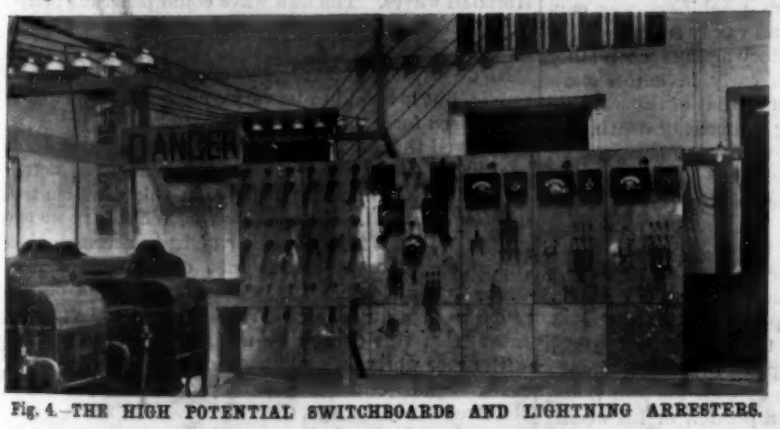

Fig. 4.—THE HIGH POTENTIAL SWITCHBOARDS AND LIGHTNING ARRESTERS.

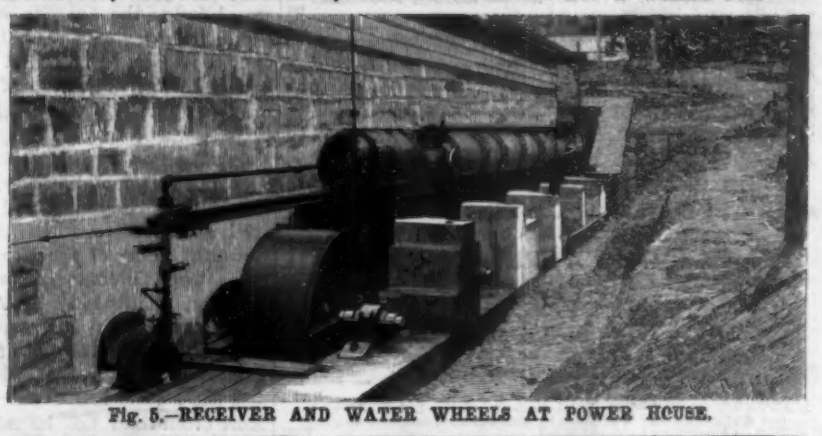

Fig. 5.—RECEIVER AND WATER WHEELS AT POWER HOUSE.

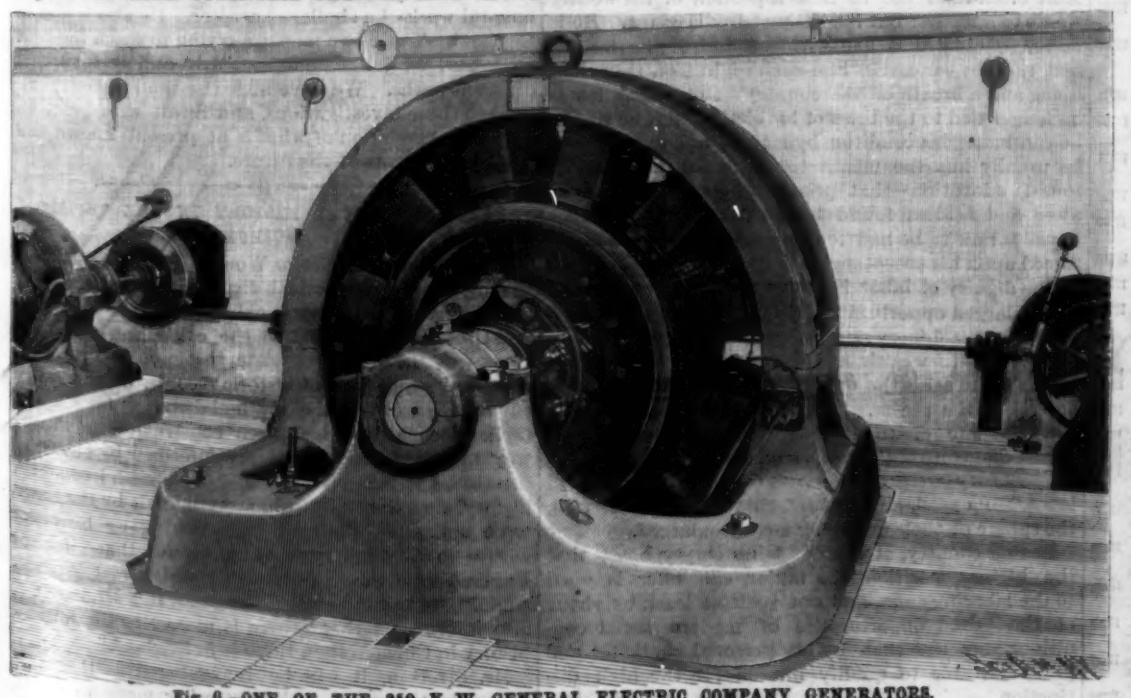

Fig. 6.—ONE OF THE 350 K. W. GENERAL ELECTRIC COMPANY GENERATORS.

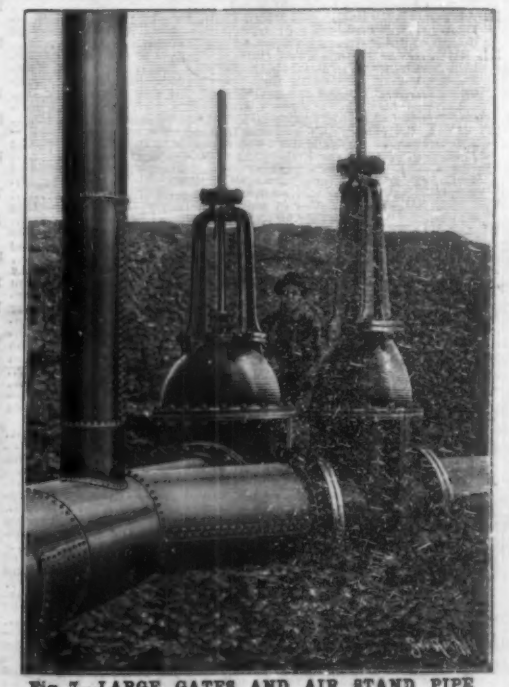

Fig. 7.—LARGE GATES AND AIR STAND PIPE AT THE HEAD OF PIPE LINE.

THE LONG DISTANCE ELECTRIC POWER TRANSMISSION PLANT AT FRESNO CALIFORNIA.—[See page 200.]

Scientific American.

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NEW YORK, SATURDAY, MARCH 27, 1897.

Contents.

(Illustrated articles are marked with an asterisk.)

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Scientific American Supplement

No. 1108.

For the Week Ending March 27, 1897.

Price 10 cents. For sale by all newsdealers.

THE EMANCIPATION OF LABOR.

One of the most significant achievements of the century which is now drawing to a close is the degree of social comfort and political power which have been won by the laboring man.

The dignity of labor, so called, has passed from a pretty theory to a recognized fact.

Despite the painful privations which result from occasional industrial depression; despite the wicked and oft-repeated lie of the social agitator, who would have us believe that "the rich are growing richer and the poor poorer"; and despite the assertion that paupers are multiplying in our midst—the fact remains that the dawn of the twentieth century will find the laboring classes possessed of a reasonable share of the good things of this life, and firmly established as one of the most powerful factors in the social and political world.

It was not always thus. Time was when labor and slavery were inseparable terms. The land and the man who tilled it were sold together. The serf behind the plow received much the same treatment as the ox in front of it, and there was little to choose between the huts of the laborers and the stalls of the cattle. Even as late as the feudal times, with their supposed civilization, labor was enthralled to the robber barons, and the inhabitants of the cluster of homes that nestled for safety beneath the castle walls knew practically nothing of the sweets of liberty.

Coming down to as late a period as the eighteenth century, when manufacturing was yet done by hand, and most of it in the homes of the people, we find that the emancipation of labor was proceeding with slow and halting footsteps. The workman was dependent on the master to an extent that it is difficult to understand in the present day. His employer was frequently master and landlord in one, and labor took from capital what scanty wages it was pleased to pay. Travel was costly and difficult, and the artisan lacked the means if not the courage to go far afield in search of work. Whether or no labor was more contented under these simpler conditions is not now the question. If it did not crave for the domestic comforts, the educational opportunities, and the social and political powers which it has won for itself to-day, it was because for lack of opportunity it had never tasted their sweets and knew nothing of their value.

If we except the abolition of serfdom and the priceless blessing won by Magna Charta, it is safe to say that the nineteenth century has seen a greater uplifting of the laboring man than any, and perhaps all, that preceded it; and if one were to name the cause, he would have to point above everything else to the marvelous mechanical developments of the past one hundred years. History, it is true, tells us that labor was blind to the benefits which machinery was capable of working on its behalf, and vainly endeavored to shut the doors of mill and factory against each labor saving device. The lives of the early inventors show that no opposition was so bitter as that of the working classes, whose distrust is dying a lingering death, and shows itself on rare occasions even in the present day. As a matter of fact, however, the steam engine, the telegraph, the rolling mill and the multitudinous industrial arts of the century have been among the most powerful causes of the rise of the workingman to his present position of social comfort and political power.

Labor, particularly in America, is self-respecting, intelligent, independent, and possessed of social comforts which a century ago fell to the lot of the rich alone. It has risen to the dignity of proprietorship, and the artisan is in a position to own his own home. More often than not he adds a portion of his weekly wages to a modest but increasing bank account. He is no longer obliged to live within sound of the factory bell, and the car carries him each night to a suburban home and a breath of the country's sweet air. He is no longer tied to the town of his birth, and if he thinks he can better his condition by moving to a distant city, he usually has the means to make the journey. A sound education—that priceless boon, so hungered after and seldom found by the workman of earlier days—is now to be had for the asking, or is actually forced upon his acceptance.

The dignity of labor is to-day universally conceded. The enlarged opportunities which have come with the growth of machinery and manufacture have opened up the avenues to wealth and power, and labor has not been slow to seize the opportunities, grasp the wealth, and wield the power. The laborer of to-day is often the magnate of to-morrow. Many of the master minds that control the industrial and public affairs of this country were once enrolled in the "ranks of labor," so called, and, indeed, they are laborers still, the sphere of their toil being merely enlarged.

In this country, at least, it is no empty boast that the highest position the nation can offer is open to the laboring man, and one such at least, by virtue of the grand opportunities of modern social conditions, not less than by his personal character and gifts, was able to qualify himself for the high distinction.

As regards the future, the advancement of the artisan will be best promoted by the closer union of labor and capital. Every blow that has struck off the chains of the employed has clinched another rivet in the bonds which unite his interests to those of the employer. The positive identity of the interests of labor and capital is a fundamental fact which is slowly but surely receiving recognition, and the day is not far distant when labor itself will boldly give the lie to the social agitators and irresponsible demagogues who would have it believe that labor and capital are in the nature of things unalterably opposed.

It should never be forgotten that enlarged opportunities impose serious responsibility. There is a danger lest labor, exulting in its ever growing strength, should be tempted to use it for unlawful and selfish ends. To this temptation it will never yield if it remembers that the interests of society at large and labor and capital in particular can best be subserved by a conservative and fair minded use of those social and political powers which are the sign of its own complete emancipation.

NEW POSSIBILITIES OF ELECTRICITY.

No one has the temerity in this day and age to say what may or may not be done through the agency of electricity. Some of the foremost physicists and electricians in this country have made great strides in unfolding the character and capabilities of this subtile force, and have dared to expect to do things not even dreamed of a few years ago. They are now working in full expectation of accomplishing results of great importance. Nothing has been uttered by these men in the nature of a prophecy, but they seem to have had some evidences of the possibility of carrying investigations far beyond the expectations of the most visionary.

The same feeling pervades Europe, and much of the best work in this direction has been done in that portion of the globe. For some time past Mr. W. H. Preece, chief of the electrical department of the British postal system, has been making experiments in telegraphing through the air without wires, and with considerable success; but recently Mr. Preece has yielded the palm to a young Italian inventor, Guglielmo Marconi, whose experiments have demonstrated the superiority of his system of telegraphy without wires. He has carried on these experiments with the sanction and support of the postal department and with the cooperation of Mr. Preece and other engineers. Mr. Marconi, in making use of the Hertzian waves, discovered that impulses set up in his apparatus were able to affect a receiver placed on the further side of a hill. Morse signals could be sent with ease through the larger part of a mile of earth and rock. He found he had discovered a new form of energy that did not exist in the Hertzian waves. The new wave could penetrate everything and could not be refracted or bent aside from a straight path.

No description of Marconi's apparatus has been made public, but it is said to be very compact and capable of being used for military, marine and other purposes. It is believed that this system of telegraphy and signaling has capabilities within it that will astonish the world. Certainly, the limit of knowledge in this direction has not been reached. The question is, What may we expect? Will this form of energy assist in accomplishing the much discussed transference of thought, or telepathy? Will it enable a person at one point on the globe to communicate with another on the opposite side? Can this energy be utilized in communicating with other worlds?

Dr. Jagadis Chunder Bose, a professor of physics in the Presidency College, Calcutta, has done much experimental work of a similar character. He also is now in England. These two men are trying to reach the same goal, but, we judge, independently and by somewhat different paths. We have little else than rumors in regard to these investigations, and await with great interest the revelation of what is at present known and the developments of the future.

ENGLISH RAILWAY HISTORY IN THE CHICAGO MUSEUM.

Visitors to the Chicago World's Fair will remember the magnificent historical display of locomotives and railway records which was exhibited by the Baltimore and Ohio Railroad. While the exhibition of locomotives was the most complete thing of its kind ever shown, the collection of historic records, which consisted very largely of the original drawings from which earlier locomotives had been constructed, was in its way of equal merit. We are informed by Mr. C. E. Stretton, the well-known writer of English locomotive history, that the efforts which were made by the Baltimore and Ohio Railroad in gathering up historical matter in England were so successful that "if we in England want the true history of early Great Western engines, we have to go to Chicago for it." Mr. Stretton also informs us that "there is more English railway history in Chicago than there is in England."

Mr. Stretton, it will be remembered, is the chief mover in the effort which is being made to establish a national railway museum in England, and it is safe to say that he is the best authority on railway

history on the other side of the water. Our regret that English locomotive engineers should be deprived of these valuable records for use in their projected museum does not prevent us from expressing our satisfaction that the Field Museum, in Chicago, is proportionately enriched. The moral of the incident is that no time should be lost on either side of the water in gathering together the scattered remnants of drawings, records, etc., which are liable to be lost or destroyed or sold, through failure of the parties who own them to appreciate their intrinsic historical value.

THE JUDGMENT IN THE CORDITE CASE.

The celebrated cordite case, in which Mr. Hiram Maxim is suing the English government for infringement of his patent for the manufacture of smokeless powder, has been one of the sensations of the naval and military world, and calls to mind the celebrated Nobel case of a few years previous. Mr. Maxim, who is one of the most successful inventors and manufacturers in the field of guns and explosives, is the inventor of a smokeless powder which bears his name and is perhaps the most successful powder of its kind on the market to-day.

The English government is making and using a smokeless powder to which it has given the name of cordite. It closely resembles the Maxim powder, and so directly infringed some of the most important claims of his patent that the patentee carried the matter to the courts. The case has attracted unusual interest, both because of the great celebrity of the plaintiff and the many millions of dollars which were involved in the decision.

Nitro-glycerine, as every one knows, is much too violent to be employed in firearms. If a gun should be loaded with a charge of dynamite and be set off with a fulminating cap in the ordinary way, instead of propelling the shot at a high velocity, it would blow both the gun and the shot into atoms.

Guncotton, that is, tri-nitro-cellulose, is also a very violent explosive, but if it is dissolved in acetone and the residue dried, it may be employed in a gun when nearly in a dry state; that is, if it has about 2 per cent of acetone in the compound it holds its shape and may be used as a propellant in firearms, but it is apt to get too dry. When the last vestige of solvent escapes, it is very apt to crack, exfoliate, and become porous and scaly. In this condition it is too violent to use in a firearm. However, if a small portion of castor oil is mixed with the solvent, the solvent dries out and leaves the castor oil, and the guncotton may thus be advantageously employed in almost its pure state. Camphor acts in the same manner as castor oil, but camphor evaporates after a time, leaving the cellulose in its pure state, when it becomes dangerous.

Suppose now that a small quantity of nitro-glycerine, say 3 per cent or 4 per cent, is combined with the guncotton, it prevents it from getting too dry, and makes it burn very much slower; in fact, nitro-glycerine may be said to "slow the mixture" until about 10 per cent is added.

In 1888 Hiram S. Maxim combined high grade guncotton, that is, the insoluble variety of tri-nitro-cellulose, with nitro-glycerine to form an explosive, but as the tri-nitro-cellulose was not soluble in nitro-glycerine, it was dissolved in acetone. The acetone was then evaporated out, leaving the compound nitro-glycerine and true guncotton, and, to insure a greater degree of stability and uniformity in burning, various oils were experimented with. However, in the end castor oil was found, everything considered, to be preferable; so the next year another patent was taken out for a powder consisting of tri-nitro-cellulose, nitro-glycerine and a suitable oil.

The second claim of Mr. Maxim's patent is as follows: "The manufacture of an explosive compound by first dissolving guncotton by means of acetone or other solvent and then incorporating with the dissolved guncotton, nitro-glycerine or similar material and castor oil or other suitable oil substantially as hereinbefore described."

The English government had been using cylinder oil in place of castor oil, and to avoid the Maxim patent they called it "mineral jelly." Cylinder oil is the product of the same filtering process as is used in producing vaseline, and the government experts were obliged to admit in the trial that its utility for powder making is the same. One witness claimed that the cylinder oil was used, not to moderate the explosion, but to lubricate the bore of the gun. The same witness for the government had previously testified that the oil was used to prevent detonation — this testimony having been given in the Nobel trial.

The judge gave judgment against the plaintiff. The burden of the judgment was to the effect that the cylinder oil which the government used was not an oil but a hydrocarbon, or at any rate that it could not be considered under the head of a "suitable oil." It was also decided that the proportions used by the government were different from those of Mr. Maxim, consequently they did not infringe in that respect; and yet it was admitted that according to the first claim of the patent all proportions were included. It will be understood, of course, that the judgment was not against the validity of Mr. Maxim's patent. It decides that the patent is valid but that the government has not infringed.

THE HEAVENS FOR APRIL.

BY WILLIAM R. BROOKS, M.A., F.R.A.S.

The sun's right ascension on the first of the month is 0 h. 45 m. 0 s.; and its declination north of the celestial equator 4 deg. 50 m. 16 s.

On the last day of the month the sun's right ascension is 2 h. 32 m. 37 s.; and its declination north 15 deg. 0 m. 18 s.

Although we are now at the minimum period of the sun spot cycle, an occasional fine group may be seen. The great naked eye spot of January last, which was nearly 90,000 miles in length, appeared by rotation of the sun in February and March, in accordance with the prediction, and will probably be again seen well advanced on the sun's disk on the first of April. At each reappearance in February and March, the group had changed considerably in shape and was reduced in size, although visible to the naked eye through a smoked glass.

MERCURY.

Mercury on the first day of April, at 10 hours, is in superior conjunction with the sun, or exactly in a line with the earth and sun beyond the sun. Mercury then changes from morning to evening star. This little world, about 3,000 miles in diameter, moves so swiftly in its journey around the sun that, by April 28, it will reach its greatest elongation east of the sun, 20 deg. 43 m. This will be the best time to look for Mercury in the western evening sky, its northern declination being very favorable indeed. Another interesting fact, and one of great value in identifying this shy little planet, is that, at the time of its greatest elongation from the sun, it will be just eastward of the well known Pleiades.

On April 17, at 4 hours, Mercury and Venus will be in conjunction, when Mercury will be 5 deg. 13 m. south of Venus.

The right ascension of Mercury on April 1 is 0 h. 45 m. 0 s., and its declination north is 3 deg. 40 m. 40 s. On the last day of the month its right ascension is 3 h. 52 m. 59 s., and its declination north 22 deg. 59 m. 40 s.

VENUS.

Venus is still our lovely evening star, and will continue as such through nearly the entire month. On April 28, at one o'clock, it comes into inferior conjunction with the sun and then changes to morning star. Its northern declination will keep it a conspicuous object in the western evening sky during the early portion of the month. All should attempt to secure a telescopic view of Venus during the first week or two of April, for, seen in the telescope, it presents a most beautiful crescent phase, resembling the new moon two or three days old. The apparent diameter of the cusps will increase, while the crescent will become more slender until inferior conjunction.

The conjunction of Venus with Mercury on April 17 has been referred to in the section on Mercury.

On April 4, at 6 h. 52 m., Venus will be in conjunction with the moon, when Venus will be 1 deg. 35 m. north of the moon. Venus is stationary on April 6, which means that its motion is in the line of sight, and in this case, toward the earth.

On the 1st of the month Venus crosses the meridian at 2 h. 6 m. in the afternoon, and sets at half past nine in the evening.

On the last of the month, being near to inferior conjunction, Venus crosses the meridian and sets almost simultaneously with the sun.

The right ascension of Venus on April 15 is 2 h. 43 m. 47 s., and its declination north 22 deg. 53 m. 28 s.

MARS.

Mars is evening star, being somewhat west of overhead at early evening and in the constellation Gemini the Twins.

On April 8, at nine o'clock in the morning, there will be a very interesting conjunction of Mars and the third magnitude star Epsilon Geminorum, when Mars will be only two minutes of arc south of the star.

The nearest approach, occurring as it does in full daylight, will only be observable in the telescope. But on the evening of April 7, before the conjunction, and on the evening of the 8th, after the conjunction, the star and planet will be seen very close together. Their change of position will also afford an interesting illustration of the planet's orbital motion.

On April 9, at 3 h. 52 m., Mars is in conjunction with the moon, when the planet will be 50 m. of arc south of the moon.

On April 16, at 8 h., Mars reaches its greatest heliocentric latitude north.

On the first of the month Mars crosses the meridian at 5 h. 41 m. in the afternoon, and sets 1 h. 20 m. after midnight. On the last of the month Mars crosses the meridian at 4 h. 47 m. and sets 20 m. after midnight.

JUPITER.

Jupiter is well up in the eastern evening sky as soon as it is dusk. It is in Leo, a few degrees east of the bright star Regulus, where it will remain apparently almost stationary among the stars during the latter part of the month. Jupiter is splendidly placed now for telescopic observation during a large part of the night. The structure of its wonderful belt system is exceedingly interesting, showing much complicated detail. The phenomena of its satellites will also prove of great interest. Some instances here follow.

On the evening of April 4, at 8 h. 38 m., satellite I will enter upon the disk of Jupiter in transit. At 9 h. 31 m. the shadow of satellite I will enter in transit. At 10 h. 57 m. the egress of satellite I will occur; and at 11 h. 50 m. the shadow of satellite I will pass off the disk. On April 6, at 8 h. 5 m., satellite III will enter upon the disk of the planet in transit. At 11 h. 39 m. the satellite will leave the disk; and at 11 h. 48 m. the shadow will egress. On April 16, at 7 h. 55 m., the shadow of satellite II will enter upon the disk. At 8 h. 40 m. satellite II will pass off the disk. At 9 h. 23 m. satellite IV will reappear from an occultation. At 10 h. 46 m. the shadow of satellite II will pass off the disk. On April 13 at 5 h. 56 m. Jupiter is in conjunction with the moon, when the planet will be 3 deg. 8 m. north of the moon. On April 1 Jupiter crosses the meridian at 9 h. 32 m. P. M. and sets at 4 h. 20 m. A. M. On the last of the month it crosses the meridian at 7 h. 34 m. P. M. and sets at 2 h. 15 m. A. M.

The right ascension of Jupiter at the middle of the month is 10 h. 11 m. 39 s.; and its declination north 12 deg. 32 m. 38 s.

SATURN.

Saturn is morning star, rising, however, at 10 h. 30 m. P. M. at the opening of the month; very good observations may be had with the telescope after midnight. On the first of the month it is on the meridian at 3 h. 11 m. A. M. The right ascension of Saturn on the fifteenth of the month is 15 h. 51 m. 51 s.; declination south 17 deg. 52 m. 26 s.

URANUS AND NEPTUNE.

Uranus is in Scorpio near its northwestern border. Its right ascension for the middle of the month is 15 h. 44 m. 15 s.; and its declination south 19 deg. 33 m. 17 s. Neptune is between the horns of Taurus. Its position for the middle of the month being, right ascension, 5 h. 8 m. 54 s.; declination north, 21 deg. 34 m. 25 s.

Smith Observatory, Geneva, N. Y., March 18, 1897.

MAGNETIC METAL EXTRACTION.

Magnetic extraction of metals from ores is successfully practiced at the Franklin Furnace, New Jersey, in the Edison plant operating there. The method is described thus: There are three sets of the magnets, 74 in the first set, 320 in the second, and 320 in the third set. The magnets are about four feet long, and the ore on its journeyings has to pass a mile of faces of magnets. Right here is presented what to the layman is a most remarkable feature of the process. The magnets are arranged in tiers of five in a tier. The top one is weak, but they increase in strength as they go down, until the bottom one is very powerful. The ground rock passes through the screen and starts downward in front of the magnets. The magnets jerk the particles of iron oxide from the mass as they descend; but the iron does not adhere to the magnets. And right here is a most surprising sight. The ore, in passing the first magnet, inclines toward it. As it rushes down, the ore swings in more toward the magnets, until as it reaches the last one it curves inward and under it in a half circle, without any particle of ore adhering to the magnet. In the first passage past the magnets small quantities of stone stick to the ore. The ore is carried upward and started down before the second lot of magnets after passing through a mill which grinds off the particles of stone. The first set of magnets extract 62 per cent of oxide of iron. When the mass has passed the second set of magnets, there is in it 75 per cent of oxide of iron. Then it is ground again and passes the third and most powerful set of magnets, which takes the phosphates out and makes Bessemer of it. The percentage of iron oxide is then from 85 to 87.

[McCaul's Factory, from which the above is taken, fails to state how much coal and how many horse power is required to crush a ton of the ore and operate all the magnets used in the separation. The SCIENTIFIC AMERICAN readers would like to know.—Ed.]

RAPID BRIDGE ERECTION.

We have recently had occasion to make note of instances of rapid bridge erection, and we are now in receipt of a letter from Mr. W. F. Chapman, of Montreal, Canada, giving us the latest and in some respects the most remarkable case of this kind on record. We are informed that at Vandreuil, Quebec, a place about twenty-five miles from Montreal, the Grand Trunk Railway Company recently took out a 98 foot iron span in the brief period of eight minutes, and erected a new one in its place in forty-seven minutes. The whole operation, including preliminary preparations, occupying only three hours. The weight of the bridge is not given, but the performance was, in any case, very remarkable, and we agree with the writer that it was probably unprecedented.

AN IMPROVED ROTARY PUMP.

A pump designed to work with but little friction, and which is not liable to be impeded in its operation by sand and silt in the water, is shown in the accompanying illustration, and has been patented by John S. Attenhofer, of No. 4936 Laurel Street, New Orleans, La. Upon the outer ends of curved spokes are curved buckets, whose passages are substantially equal in cross section, as shown in the small view, and an annular plate covers the sides of the buckets and the annular space within which they lie. The annular plates have on their outer sides recessed annular spaces, designed to retain a thin layer of air to reduce the friction between the wheel and the casing. The center of the wheel is entirely open within the annular spaces occupied by the buckets, and surrounding its periphery is a discharge casing from which rise one or more discharge pipes. In the periphery of the wheel are grooves in which are packing rings bearing against smooth surfaces upon the inner face of the discharge casing, preventing leakage by the edge of the wheel. The wheel is designed to be suspended in the water and not to rest upon the bottom unless it is to be used for pumping sand, and the

ATTENHOFER'S ROTARY PUMP.

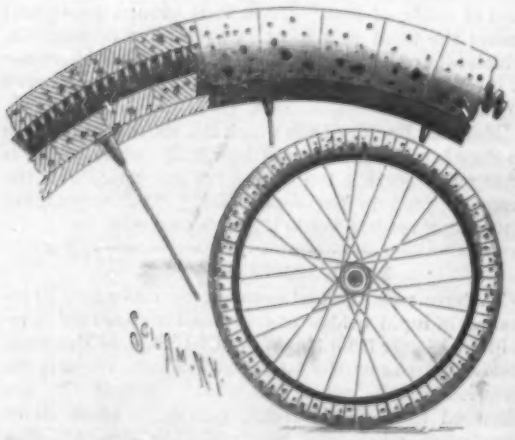
casing of the annular bucket portion above and below prevents the friction due to the contact of the revolving portions of the wheel with the surrounding water.

The Height of Trees in Summer and Winter.

It has, perhaps, occurred to few of us that the boughs of trees occupy a very different position in summer and winter respectively, but Miss Agnes Fry, says Public Opinion, has made careful measurements of the height from the ground of branches of both walnut and mulberry trees in August and December, and she finds that in some cases there is a difference of as much as thirty-one inches in the height of the same branch from the ground in these two months. One particular figure was obtained with a branch of a mulberry tree, and it was found that in December a weight of thirty-five pounds was not sufficient to lower it to its summer position. In other cases there were differences of from thirteen inches to nineteen inches in the distance in summer and winter respectively of branches from the ground. No wonder, then, that the diagnosis of a tree in winter from its general outline is so difficult a task.

A CORK TIRE FOR BICYCLES.

The illustration represents a bicycle tire made of three separable segmental sections of cylindrical pieces



BURTON'S BICYCLE TIRE.

of cork, each having a central opening, and the pieces forming the sections being cemented together with these openings in alignment, forming a central tubular passage though the sections entirely around the tire. The improvement has been patented by John A. Burton, of Skaneateles, N. Y., and, as will be seen by the sectional view, an endless coil spring is inserted in the continuous passage formed by the three sections placed together. The tire may thus be readily placed in position on the rim, the spring holding the sections together, or the sections may be readily drawn apart sufficiently to allow of the removal of the tire, as may be desired.

THE WORDEN HICKORY FRAME BICYCLE.

Among the greatest improvements which have been effected in modern bicycles is the abolishment of vibration. The original bone shaker with its iron tired wheels was exceedingly hard upon the rider. The improvement which played the greatest part in the creation of the modern bicycle was the introduction of the solid India rubber tires. Even with these the vibration was so troublesome that many people more or less delicate in constitution could not ride. Then the pneumatic tire made its appearance, and in the face of much opposition became universal, attempts to supplant it by the less resilient cushion tire being failures. The tendency is now to dispose of the residual vibrations of the bicycle. In this direction could be named the use of the wooden rims for the wheels which have now almost universally taken the place of the metal ones and the wooden handle bars which at the present day are so much in favor with the riding public. The introduction of wood into the construction of the bicycle may be termed one of the great movements of the day, and one of the most recent efforts in this direction is shown in our cut; it is the substitution of hickory for steel tubes in the frame and is manufactured at the Worden Hickory Frame Cycle Works, Syracuse, N. Y.

The cut is self-explanatory. The wooden bars are drilled out at the ends to a depth of about six inches. To the metal junction pieces of the frame short metal tubes are cast in which enter the holes in the wooden bars. The ends of the wooden bars then enter a socket with a thread cut on its outside, which sockets are part of the junction pieces. A wire ring is sprung into a groove between two and three inches from the end of the wooden bars. A thimble whose end is spun in so as to fit tightly the diameter of the bar, and thus cannot pass over the steel ring, is screwed over the outside of the socket, drawing the wooden bar down into the socket, making a species of union joint. In this way the most rigid construction is secured, and, instead of the easily bent steel tubes, we have unbendable and well nigh unbreakable bars. This is not all; by unscrewing the thimbles, the frame can be taken apart and reassembled by anybody. In case of damage it can be repaired for a nominal sum, as there is no question of re-enameling or brazing. It is believed, however, that such repairs will very rarely be required. The logical sequence of the wooden handle bars which have become popular is the doing away with the vibrations by the adoption of the wooden frames, which is a further step in the same direction.

Montreal Bridge.

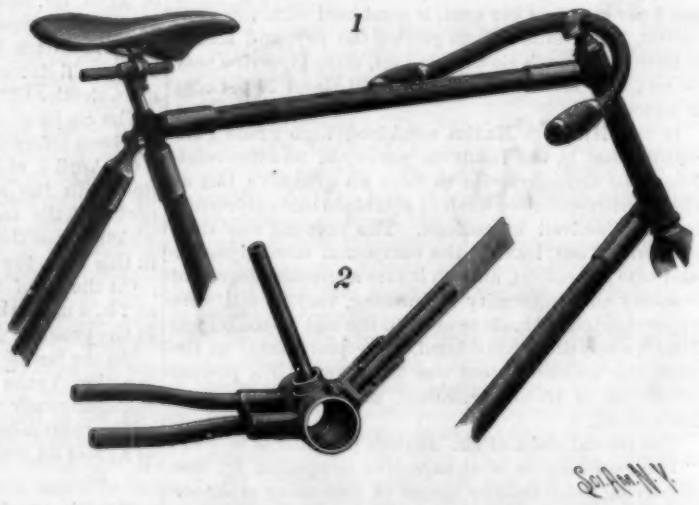
The Montreal Bridge scheme, says the Montreal Gazette, has received considerable impetus as the result of a conference between Premier Flynn, of the Province of Quebec, and a deputation of interested citizens from the south shore of the St. Lawrence. Resolutions were adopted and presented by the deputation advocating the speedy erection of a bridge across the St. Lawrence River at Montreal. In answer to questions from Mr. Flynn, Mr. C. N. Armstrong, managing director of the Montreal Bridge Company, stated that the estimated cost of the bridge proposed by his company was $6,000,000, and the company asked 15 per cent from the Dominion government, 15 per cent from the city of Montreal, and a like amount from the Quebec government. He added, however, that the company would be disposed to go on with the work even with a grant from the province slightly reduced from this figure. The capital of the company was said to be $3,000,000, with $700,000 subscribed, and 10 per cent of the latter sum paid up. He said a New York syndicate was ready to build the bridge on the terms named and spend an additional $2,000,000 on terminal facilities. It was understood that the grants asked from the Dominion and the city governments were to extend over twenty years, with the first payment due only upon the completion of the bridge. Premier Flynn said that without giving a definite promise, he was disposed to aid the enterprise as far as the resources of the Province of Quebec would justify. He approved of a railway along the south shore of the St. Lawrence and a bridge at Montreal; but the province had paid out $34,000,000 for railway construction since confederation, and, while it was rich in resources, the province must realize on these resources and act in a prudent and economical manner.

A NOVEL THREE CRANK BICYCLE.

The illustration represents a bicycle designed to facilitate utilizing the weight of the rider, in addition to the pressure ordinarily produced by the feet, for the propulsion of the machine, thus augmenting the total propelling power and giving the body of the rider a movement similar to that of a pedestrian. In this bi-

MERRILL'S BICYCLE.

cycle are embodied the elements of three inventions, one patented in 1881, one in 1884, and one for which a patent has just been issued, the inventor being Nelson Merrill, of Altamont, N. Y. The pedal crank of this machine is a three crank shaft, dividing the circle into three parts instead of two, as is the ordinary practice, thus obviating all dead centers, and the third crank is connected with a vertically sliding saddle post or standard which moves freely up and down between grooved rollers arranged in a boxing in the top bar of the frame, as shown in Fig. 2. The arrangement is such that, while the pedals are rising, the crank with which the saddle standard is connected makes its downward movement, the weight of the body being thus applied to assist propulsion. There is also a second or idle crank connected with and six inches in front of the pedal crank, there being a shoelike connection between the pedals of the cranks, this feature being designed to afford more freedom and a better support for the feet, in connection with the movement of the saddle, which has a slight fore and aft as well as an up and down motion. To the rear of the saddle are connected shoulder



THE WORDEN HICKORY FRAME BICYCLE.

straps, adapted for application as shown in the full and dotted lines of Fig. 1, so that when the rider presses down upon the pedals, and raises his body, he will exert an upward pull on the crank with which the saddle standard is connected. The improvement is also designed for application to tricycles and all forms of foot propelled vehicles.

Starch Luster.

Heat together 90 parts of spermaceti, 50 parts of gum arabic, 50 parts of borax, 120 parts of glycerine, and 750 parts of rain or distilled water, with constant stirring until complete solution is achieved. Let cool, and fill into suitable bottles, which must be thoroughly stoppered. Directions: Take 1 ounce of good starch, and add just enough cold water to make a paste, carefully rubbing with a spoon until all lumps are broken down. To 1 pint of boiling water add 5 tablespoonfuls of this liquid, pour the whole over the starch paste, and boil for not less than half an hour. These proportions are intended for collars, cuffs, and fine shirt bosoms. For other articles less of the liquid is required.—National Druggist.

THE CHARLTON STREET SWEEPER.

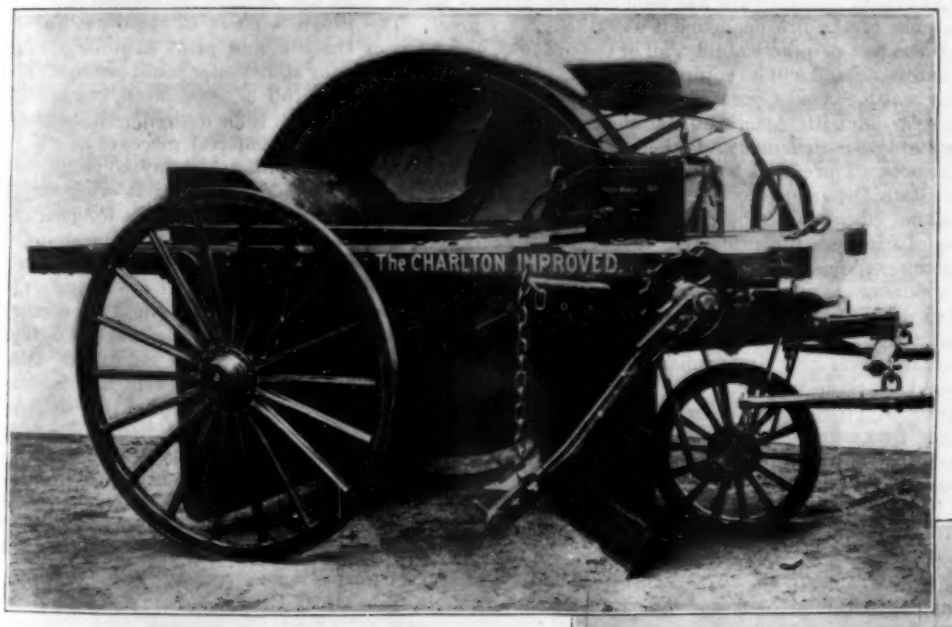
The Charlton improved street sweeping machine, shown in the illustration, is of strong and simple construction, and has been proved to be of high efficiency, considering both the thoroughness with which it does its work and the quantity of work it is capable of. It weighs about 2,500 pounds, and is a light draught for two horses. The diagonally hung broom is operated in the usual manner, but the dirt, instead of being left in a windrow on the street, is swept into the open side of the drum represented in the figures. To facilitate this a flaring rubber flange is attached to the edge of the drum, which flange flattens where it touches the pavement, and thus forms an inclined plane, up which the dirt is swept into the drum. This is done with the utmost neatness, though the surface of the pavement may be quite uneven.

Buckets extend across the inner concave face of the drum, and serve to lift the sweepings up to the discharge chute. The latter is kept in position by a spring, which yields in case a large stone or other substance is taken up by the sweeper. So practical is this arrangement of the parts that Belgian block paving stones have been picked up by the machine without injury to it, and, on the other hand, in sweeping a wet asphalt pavement, the cart body of the machine has been half filled with water taken up. The outer edge of the rubber flange was at first protected by thin steel clips, to save it from wear; but this has been found unnecessary, as the flange has good endurance for the service, and it can be replaced at but small expense. The discharge chute empties into a box body, similar to that of an ordinary dumping cart, and which is readily dumped and again brought to upright position by the movement of a lever at the right of the driver. The free end of the broom works up to the curbstone, thus effectually cleaning the gutters.

With the street sweepers at present in general use, as is well understood, the dirt is swept to one side of the street, where it is left in a long, thin line to be swept into little hills by gangs of men following, it requiring a great many of these small accumulations to fill one of the carts which subsequently come along to gather up what has not already been scattered again by the wind or by the wheels of passing vehicles.

Through the courtesy of the street cleaning department, the Charlton street cleaner last year underwent a thorough test in New York City on Fifth Avenue and Upper Broadway, sweeping some seven hundred miles of streets in conjunction with the department sweepers. The method employed was to pick up the dirt, which had previously been swept into or adjacent to the gutters, on each side of the avenue, by ordinary sweepers moving en echelon. During a part of the time the operation of the machine was observed by competent engineers who were engaged to witness and calculate the amount of work done. A portion of their report shows that during their observations, amounting in all to fifty seven hours, a distance of 128 miles was swept by the method above described; 129·34 cubic yards of dirt were picked up and deposited at convenient corners, in piles of 0·61 cubic yard each, at an average distance of 866 yards between each two piles. Since this test the sweeper has been greatly improved by carrying the sweepings directly into the drum instead of upon a belt as formerly, materially reducing the weight of the sweeper and increasing the efficiency, making the light and compact machine shown in the illustrations.

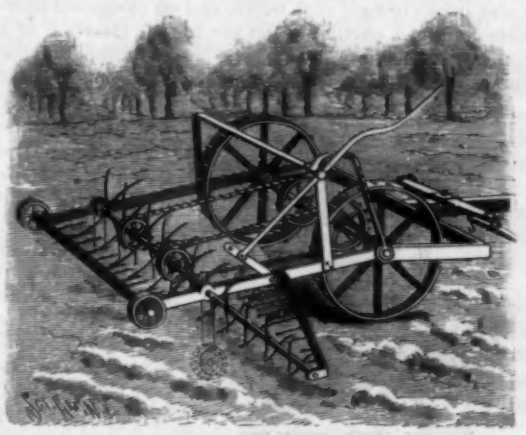
The machine shown in our illustration is being introduced by Marshall McLean, of No. 59 William Street, New York, the machines being built at the factory of the Shadbolt Manufacturing Company, Brooklyn, N. Y., under the direction of G. W. Brady. In its improved form it was in active operation in Newark, N. J., for several weeks under the auspices of the Public Works Department of that city. It was there used to clean the entire street and swept from 2½ to 3 miles of streets in a day of eight hours, seven strokes cleaning the entire street from curb to curb.



STREET SWEEPER—SIDE VIEW, BROOM REMOVED.

A CULTIVATOR FOR USE IN ORCHARDS.

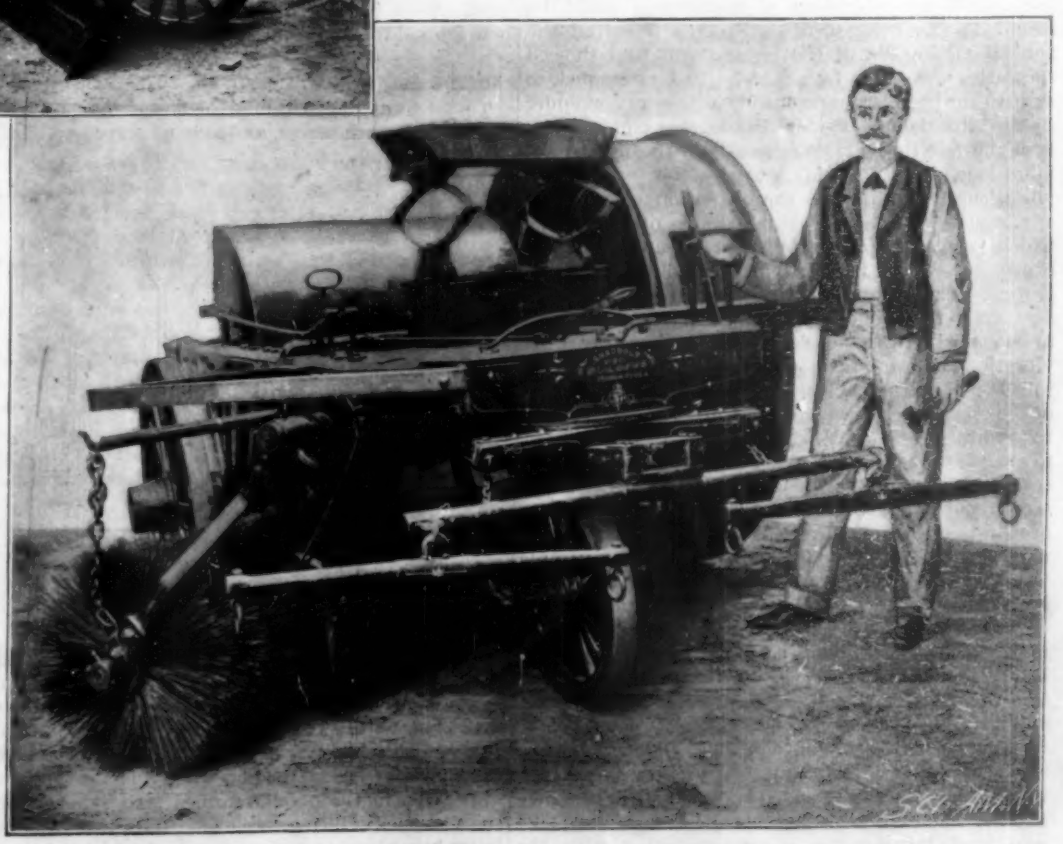
A cultivator which is more especially designed for working the ground around trees, particularly orange, lemon, and olive trees, cultivating the ground close to the trunks of the trees without interfering with their roots, is shown in the accompanying illustration, and has been patented by Louis H. Smith, of El Cajon, San Diego County, Cal. The pole or tongue of the cultivator is attached to a U-shaped frame which extends forward from the main axle, and in side bars extending rearward from the axle is held the cultivator shaft, carrying curved teeth. A rearwardly extending cleaner frame is pivotally connected with the rear ends of the side bars, and this frame has small wheels adapted to be brought in contact with the ground, raising the teeth of the cultivator, when the latter is taken to or moved from the field, or raised therefrom, as shown in the illustration, when the cultivator is in working position. Coupled at one side to the main cultivator shaft is an extension shaft, also carrying cultivator teeth, the teeth being shorter near the outer end of the shaft, and this exterior shaft is supported by a yoke frame extending out laterally from the main frame. The main cultivator shaft and its extension are rotated by sprocket wheels and chains from the main axle, the cultivator teeth passing between the teeth of the cleaner frame at each revolution. The rear wheels are raised or lowered, taking the cultivator teeth into or out of working position, by a lever in easy reach of the driver, this lever being connected by a link with a forwardly extending side member of the cleaner frame, whereby the latter may be carried to a substantially vertical position. With this cultivator the ground beneath the lower limbs and up to the trunks of the trees may be conveniently cultivated.



SMITH'S CULTIVATOR.

Distribution of White Corpuscles in the Vessels.

It has been held by some observers—Rieder and Schultz among others—that the leucocytes are very unequally distributed through the vascular system. The subject has been worked over again lately by Sémakine, who points out various reasons for considering these experiments to be unsatisfactory, especially because they took the blood for the purposes of examination from the dead animal, when it is not inconceivable that the blood in the central parts might contain more leucocytes than those in the peripheral regions of the vascular system. Sémakine's experiments were made on dogs and on rabbits in which leucocytosis and hypo-leucocytosis were artificially induced—the former by the injection of two or three cubic centimeters of a mixture of one part of turpentine to five of olive oil into the veins, the latter by the injection of five cubic centimeters of a solution containing one part of peptone in ten of water. In some of the rabbits leucocytosis was also induced by the subcutaneous injection of one part of papayotin in two hundred of water. Enumerations of the white corpuscles were also made in rabbits killed by a blow on the back of the neck, and in dogs killed with chloroform. The conclusions at which Sémakine arrived were that, so far as regards macroscopical vessels, the leucocytes are equally distributed, so that from an examination of the blood in the peripheric blood vessels the number of the white corpuscles in the central vessels may be determined. The same general statement holds good both for leucocytosis and for hypo-leucocytosis, the number of white corpuscles being increased in leucocytosis and diminished in hypo-leucocytosis equally in both central and peripheric vessels. In rabbits the mere fixation on the table as well as a blow on the back of the neck induces some kind of vaso-motor excitement, which causes an alteration in the number of the leucocytes to occur with extraordinary rapidity. These animals, therefore, are not well adapted for enumerative experiments of this nature. The unequal distribution of the leucocytes observed in rabbits when living is dependent upon the opening of the abdominal cavity, and the differences observed by Schultz were probably due to post-mortem changes.—Lancet.



THE CHARLTON STREET SWEEPER—FRONT VIEW.

Science Notes.

The Prince of Wales, President of the Society of Arts, recently presented to Prof. D. E. Hughes, F.R.S., at Marlborough House, the Albert Medal, awarded him by the Council of the Society "in recognition of the services he had rendered to arts, manufactures, and commerce, by his numerous inventions in electricity and magnetism, especially the printing telegraph and microphone."

A bill has been introduced into the Legislature of the State of New York which authorizes the city of New York to spend $3,500,000 in the erection of a library building on the site of the old reservoir in Bryant Park, or rather adjoining it. The income of the Astor, Lenox and Tilden foundation is about $160,000 annually; so that, if the building were provided, this would be sufficient to maintain a great reference and circulating library in the city of New York.

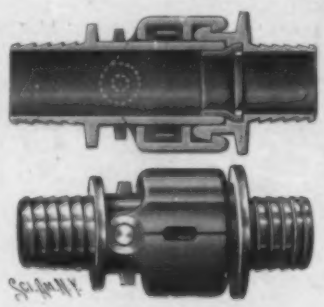
Vertical earth-air electric currents were first revealed by Dr. Adolf Schmidt, of Gotha, says Nature. In his mathematical analysis of the earth's magnetic field—the most carefully executed analysis up to date—he reached the following conclusion: The earth's total magnetic force consists of three parts, viz.: (1) The greatest part: this is to be referred to causes within the earth's crust, and possesses a potential. (2) The smallest part, about one-fortieth of the entire force; this is due to causes outside of the earth's crust, and likewise possesses a potential. (3) A somewhat larger part than the preceding; this does not possess a potential, and, in consequence, points to the existence of vertical electric currents. These currents amount, on the average, for the earth's entire surface to one-sixth of an ampere per square kilometer. The existence of such currents is indicated by the non vanishing of the line integral of the earth's horizontal magnetic force resolved along a closed curve of the earth's surface. Gauss carried out this test in a special case, and finding the integral practically zero, he assumed that the entire force is due to a potential. More recently, Prof. Rücker applied the same test. He found "no evidence in favor of the existence of vertical currents" over a region of the earth—the British Isles—which had been very minutely surveyed. The results of some preliminary investigations being confirmatory of Schmidt's conclusion, Dr. L. A. Bauer determined to carry out the test in a thoroughly systematic manner, viz., to take as the closed curves parallels of latitude, on which he read a paper recently before the Philosophical Society of Washington. The results obtained confirm those of Dr. Schmidt's more elaborate investigation. Summing up, Dr. Bauer finds that: "There are vertical electric currents which pass from the air into the earth, and back again into the air. Between 60 deg. N. and 60 deg. S. the average current intensity per square kilometer is about one-tenth of an ampere."

Sound Waves as Revealed by the Phonograph.

In a recent lecture on the above subject, says the Practical Engineer, delivered by Professor McKendrick at the third ordinary meeting of the Philosophical Society of Glasgow, the author, after describing the general nature of sound waves both simple and compound, gave a short description of the phono-autograph, an instrument which might be regarded as the precursor of the phonograph. By means of this instrument the vibrations of membranes could be recorded on a moving surface. He then described the general mechanism of the phonograph, and showed the various methods by which he had attempted to explain the peculiar marks made on the wax cylinder by the vibrations of sound. Photographs of outlines of the surface showed in a general way the number of vibrations, but they did not give the form of the vibrations. This led to the invention of a special apparatus—which was exhibited in operation—by which Professor McKendrick took advantage of the siphon recorder of Lord Kelvin, as used for ocean telegraphy. This instrument was adapted by special modifications to the phonograph, and the latter was caused to move with extreme slowness. In this way each vibration was recorded upon a long slip of paper rolled out by the machine, and the number and form of the vibrations as produced by musical sounds and by words were recorded. The lecturer then proceeded to analyze a word, and showed that it consisted of a succession of musical tones varying in pitch and in quality according to the voice of the speaker. The number of vibrations in many words was much greater than might have been anticipated. He took as an example the word "Constantinople," which, spoken by a rapid speaker, had as many as 700 or 800 vibrations. This could not be regarded as a system of shorthand, but it showed how nature constructed the sounds of words. Professor McKendrick also illustrated by experiment how the tones of the phonograph may be intensified, and how they may be caused to appeal to deaf people by stimulating the skin of the hands. It could not be said that the deaf heard by this method. That was impossible. But they could catch much of the time and rhythm of music. Possibly the method could be developed into a means of communicating with the brain of the deaf and dumb by the nerves of the skin.

A SIMPLE AND EFFICIENT FIRE HOSE COUPLING.

The coupling shown in the illustration is designed to facilitate the quick connection of two sections of hose and prevent leakage at the joint. It has been patented by John Kerns, of No. 601 West Fifty-second Street, New York City. On opposite sides of a short metal tube forming the end of one section are short pins on which are pivoted clamp jaws or hook members of general semicircular form, encircling the outer end of the tube, there being between the main bodies of the jaws and the tube a spring, and the jaws having an interior flange forming a stop for the hooks of the mating section. The springs act normally to draw the outer hooks toward each other, and an elongated aperture is formed partly in each jaw for the insertion of a tool to pry the jaws apart. The other coupling section has a ring or neck on which is an annular hook adapted to be engaged by the hooks of the jaws when the two parts of the coupling are pushed together, the meeting faces being rounded to insure automatic opening of the jaws and engagement of the opposing hooks. Within the second section of the coupling there is also held a packing nipple or ring, the other end of which enters the opposite section when the parts are coupled, thus making a tight joint, which the pressure of the water only makes the tighter. At the outer end of each section is an externally ridged neck to receive the hose, and collars serve as stops and guards for the ends of the hose.



KERNS' HOSE COUPLING.

Orders from Switzerland.

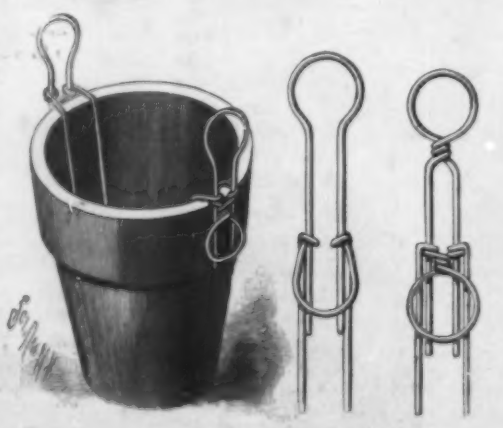
There is an inviting field for American fire apparatus in Switzerland, according to recent advices from the United States consul at Zurich. A fireman's smoke protector of American manufacture has been ordered by H. Schiess, chief of the fire department at Zurich, and if it stands the test of practicability, all of the fire departments in Switzerland will be equipped with it.

Chief Schiess has also asked Consul Germain to put him in communication with American manufacturers of firemen's portable electric lamps and other firemen's electrical appliances. The consul has transmitted the request to the State Department at Washington, with the suggestion that official notice be given to American manufacturers of firemen's life protecting inventions. The consul promises to report the results of such tests of American appliances as may be made in Zurich.

"All the fire departments of Switzerland belong to the Union of Swiss Fire Departments," writes Col. Germain, "and whatever new fire appliances one department should conclude to supply themselves with will be followed, if proved satisfactory, with orders from the other Swiss fire departments. I may add that no steam or chemical engines are in use in Switzerland, and that the old hand engines are still being used. With proper efforts, perhaps this also opens a new ground to prospect."

SIMPLE HANDLE FOR FLOWER POTS, DISHES, ETC.

To facilitate the handling of flower pots in greenhouses and other places, and also to serve as a handle for plates, saucers, etc., the simple and inexpensive device shown in the illustration has been invented and patented by William C. Krick, of No. 1287 Broadway, Brooklyn, N. Y. The device is made of wire, and consists of two parts, one of which forms a staple adapted to be inserted inside the pot, while it is bent over the upper edge of the pot and formed with eyes to receive the shanks of a lifting staple or handle, the wire of the latter being bent in various forms, of which two modifications are shown in the small figures.



KRICK'S HANDLE FOR FLOWER POTS ETC.

Education in Russia.

Through the rapid growth of Russian power in Europe and in the far East we have presented a great collision of moral forces embodied in the civilizations respectively of the empire of the Czar and of Great Britain, says the Independent. This spectacle imparts a special interest to everything by which the tendencies of Russian influence may be gaged. Is it a power making for darkness or for light? The educational test is not an unfair one, and certainly in the two departments of technical and of diplomatic training Russia may give lessons to the world. But what does her supremacy promise for popular enlightenment? The answer is suggested by her illiterate population, seventy per cent of the total. More impressive yet is the dark cloud that settles down upon provinces that have been or are in the process of being Russianized.

A few decades since the Baltic provinces had excellent schools, and in Courland especially instruction was general. Now many of the peasants, the children and grandchildren of literate parents, are unable to read and write, because they are forced to learn the Russian language, which they do not comprehend. In the interior of Russia it is estimated that there are 5,000 villages without a schoolhouse, in hundreds there are houses but no teachers. Besides, the snows and storms in winter are so severe that pupils often cannot reach the school, if one exists, for several days. Even in the spring, when the snows are melting, the roads are frequently impassable. These causes, with the innumerable holidays (i. e., church and fete days), reduce schooling to a ridiculously short period. In St. Petersburg itself, where the conditions are vastly better, it is admitted that the schools are generally overcrowded and inconveniently placed, and that from six thousand to ten thousand children of school age are kept from instruction by the want of accommodation. The mayor of the city has recently urged the necessity of a compulsory school law, while admitting, however, that there is no prospect of securing such a measure.

The Development of Russian Industry.

The British consul at Moscow, in a report on the Nijni Novgorod exhibition, describes the industrial progress of Russia since the Moscow exhibition of 1882 as very great. The progress made in textiles is marvelous, and many of the silk and print exhibits equaled anything that Lyons or Manchester could produce. The machinery section was full of good work, but agricultural machinery left much to be desired. In the mines section there were some wonderful pieces of iron work which would attract attention in any country; but although the constant remark was that every object was purely Russian, British and German foremen are largely employed in the iron works, Frenchmen in the silk and many of the print works; while British subjects have still very much to do with the cotton mills. The development of the natural wealth of the country is even greater than that of the manufactures. The production of coal has trebled in the last fifteen years.

Cotton planting prospers in Tashkent and Erivan, and the results in the new plantations of the Southern Caucasus are excellent. Costly experiments near Baku have produced a Russian tea, which is shown with much pride, and General Annenkoff is planting American vines in Turkestan; tobacco is also being grown from American seed near Samarkand. Generally speaking, every branch of industry has improved, except agriculture, which grows worse year by year. Mr. Medhurst thinks that Great Britain should still be able to supply Russia with portable engines, high pressure steam boilers, steam thrashing machinery, heavy iron plows, bicycles, and machine tools.

Calico and kindred stuffs appear to be made sufficiently well at prices which are so low that they must affect British trade; but he thinks some years must elapse before Russia can construct satisfactory spinning machinery in sufficient quantities to affect British makers. He saw nothing in the hardware section to alarm our manufacturers of high class goods, and, generally, he came to the conclusion that the trade in cheap goods is slipping away from us, but where high class articles of the best materials are required, it is admitted that the British stand first, except in Manchester goods. The consul says that when England first permitted the export of spinning and weaving machinery, in 1843, there were 350,000 spindles in all Russia, which produced yearly 5,600 tons of yarns.

In 1895 there were 5,000,000 spindles and 200,000 looms at work, producing 161,300 tons of yarns and giving employment to 400,000 hands. British and German foremen are being gradually replaced by Russians, and attempts have been made—with very indifferent results so far—to supplant British machinery by that made in Russia. Efforts to provide her own raw material have been more fortunate. In 1883 the total value of cotton goods produced in Russia was £27,790,000 and in 1892 it amounted to £38,470,000. The Russian silk trade has prospered since 1875. The woolen industry is not so prosperous. The best Russian cloth is made by an English firm, settled near St. Petersburg since 1841, which employs 2,160 hands.

The Peril of the Wire.

The overhead electric wire is responsible for many disasters to life and limb. A long list of tragedies can be credited to this cause. Fatalities are frequent, says the Age of Steel. An electric wire in its right place is a potent factor in modern business, but when, by the stress of service, time, or weather, it breaks from its holdings, and hangs like a fiery snake over the heads and at the feet of pedestrians, it is as deadly as a cobra in the tropics. It is a serpent of science, when out of its place, as it is one of its best servants when in midair. The Railway Gazette, in a recent issue, has given some startling figures of mortalities due to falling wires. In a compilation of accidents, obtained from press reports for the five months from May to September of last year, the following was obtained. As the sources of information were fragmentary and incomplete, the figures given are but an approximation of the total. From falling trolley wires there were 122 accidents; in 11 of these 12 persons were killed, and in 28 cases 31 persons were injured, and in 18 instances 24 horses were killed. Forty accidents occurred from falling electric and telephone wires, in which 9 persons were killed, 27 injured, and 7 horses made into calcined meat. Human fatalities for the period named numbered 21. At the same ratio for a period of twelve months, the death roll would include 50 persons. In contrasting this total of fatalities with those occurring on steam railroads, the Railway Gazette says, that for the year 1895 the railway mortuary list included but 38 passengers killed. Thus the deadly wire clearly outclasses the split rail, the misplaced switch, or the broken tie, or bridge. It is evident from these facts that some plan for the better protection of human life from falling wires is needed. How best to bring it about may be more or less a problem, but of its urgent necessity there can be no division of opinion. The overhead system, however carefully constructed and secured, cannot, from the very nature of things, be otherwise than a menace to public safety. In many of our cities, the lines of wires are thick and numerous as the threads in a spider's web. They outclass the complicated ravel of a full-rigged ship, and in sheer weight alone, at contiguous and intersecting points, are many tons in weight. In heavy winds, or local conflagrations, and under masses of debris or snow, the danger of these overhanging masses of copper and cable is increased. It is, moreover, a fact that, however rigid and close inspection may be, the detection of weakness and the prevention of sudden dislocation is not always possible. Wires will continue to fall, and citizens to be electrocuted, in spite of all precautions, and the death roll will still employ its copper pen until legislation supervises the deadly scribe. It has thrown its protecting shield over the railway and the mine, and sooner or later it will have a word to say on the perils of the wire.

Our Medicinal Herbs and Plants.

BY GEORGE ETHELBERT WALSH.

Forty years ago a New England kitchen garden was not considered complete without a collection of medicinal herbs for home use, such as sage, saffron, chamomile, wormwood and burdock, and all the early almanacs contained information about gathering, drying, and preparing these plants for internal and external application. It is so rare to find a garden to-day containing any of these useful plants that the question is often asked if people no longer employ them for medicinal purposes, and if the substitution of chemicals and minerals has not entirely killed the trade in herbs.

No statistics are published by the wholesale druggists to show just how many tons of common medicinal plants are consumed in this country every year; but the best informed dealers agree that twice as many are used to-day as in earlier times. The only difference is that the good housewife now goes to the drug store for her supply of herbs instead of raising them herself, and great numbers of herb gatherers and professional growers make a business of supplying the wholesale botanical druggists with the various plants. The trade in these medicinal herbs is enormous, and every wholesale botanical druggist must carry between one thousand and one thousand five hundred different plants in stock. The minerals used by the druggists are few compared with the herbs and plants, such as potash, arsenic, alum, sulphur, salt, iron, and lime, in their various forms. These are compounded in various ways with the medicinal plants, and constitute the bulk of the medicines dispensed to the public.

The manufacturers of patent medicines use great quantities of plants, but, as they generally confine themselves to the cheap ones, their supplies are made up chiefly of twenty or thirty of the common roots and barks. Some of the large concerns use twenty to thirty tons of these roots and barks a year, and many smaller ones use half that quantity.

Germany, France, and Italy send considerable quantities of medicinal plants to this country, but the American growths are considered best, and the leading druggists prefer to handle them alone. The imported horehound, centaury, coltsfoot, daisy flowers, and the roots of burdock and angelica sell at from three to ten cents a pound cheaper than the American products, and patent medicine manufacturers who have to go into the market to purchase their supplies generally take the imported because of the difference in price. The American growths are generally stronger, and cured under better conditions, and are well worth the extra price demanded. The European countries also send us aconite, belladonna, conium, feverfew, foxglove, henbane, marigold flowers, stramonium, sage, wormwood, and the balms, but, owing to duties on these, the prices are more equalized.

On the other hand, we export considerable quantities of certain medicinal plants to London and other European ports, such as lobelia and hemlock bark, and the extracted medicinal principles of many others. By exporting the alkaloids the bulk is reduced and transportation rates cut in two. The most prominent of these shipped to Europe are podophyllin, leptandrin, sanguinaria, sinecin and euonymin.

Most of the medicinal herbs grow wild in this country, and they are gathered from the woods and fields by professional herb pickers; but a few are regularly cultivated on farms and gardens. Most of the peppermint for distilling oil is grown in New York and Michigan. Sage is raised extensively on farms in Massachusetts, New York and Michigan. Nevertheless, we import over 100 tons of sage every year, and after paying three cents a pound duty it is sold at $80 and $85 per ton. The American sage brings as high as $140 per ton, and yet not more than twenty tons are raised here. Owing to the demand for it here and the inadequacy of the home supply, French and German growers have in late years been sending us a pure and superior article that brings even more than the American product. The cheap imported sage comes chiefly from Italy.

The mountains of North Carolina and Tennessee yield great quantities of medicinal herbs for the trade. Most of them grow wild there, and the pickers make a living in gathering the plants for the market at the proper season. Probably twenty tons of boneset, pennyroyal and thorn apple leaves come from these Southern mountain districts every year, and forty to fifty tons of mandrake, Culver's root, golden seal, garget root, blood root and black cohosh.

Most of the medicinal herbs that grow wild in New England are considered superior to those raised anywhere else. Almost without exception the herbs raised in New England bring $20 to $40 per ton more than those gathered in the Southern or Western States.

Until quite recently the chief supply of saffron came from Vermont, but a severe drought there killed so many of the plants that the price advanced from fifty cents a pound to $6 and $8 per pound. This induced the growers in the West and in Mexico to enter into the cultivation of saffron, and the price dropped at times as low as twenty and fourteen cents a pound. But three times since 1846 the price has run up to $5 per pound.

The common garden wormwood thrives in many old, neglected gardens, and the trade demands considerable quantities of it, but very few make a business of growing it. A good deal of this is distilled for the oil, and is often sold in bar rooms under the name of absinthe. Sixty years ago farmers raised most of it in New York and Vermont, but other farm crops crowded out the plant, and the supply comes chiefly from the wild growths in various parts of the country. France and Germany both send wormwood here, which sells about the same as the best American, although some of the imported wormwood is cheaper. Probably five times as much wormwood is imported as our farmers at home raise.

The Pacific coast sends a great many medicinal herbs to the large markets, and patent medicine men who buy their barks and roots generally go direct to the mountains of Tennessee or to the Pacific coast and make annual contracts for the delivery of a certain number of tons. California produces ten or twelve tons of horehound annually, and this, with the amount raised at Cape Cod, enters into competition with the horehound imported from Mexico and Germany.

The medicinal herbs that are in great demand to-day and which are used twenty times as much as they were in earlier days, make a pretty formidable list. Chief among the roots that have increased in popularity are Culver's root, mandrake, blood root, yellow dock, dandelion, burdock, angelica, bayberry, bitter root or dogsbane, blue flag, elecampane, golden seal, garget or pigeon berry, lady's slipper, pleurisy root, senega or snake root, spikenard, sarsaparilla, unicorn root and jessamine root. The barks of the following trees, shrubs and plants have also become of great value to the medical world, and they have steadily increased in popular favor with druggists and physicians: Prickly ash, barberry, black haws, buckthorn, cascarilla, cherry, cohosh or blacksnake root, cotton root, cramp bark and slippery elm. Of the herbs, the chief ones are: Arnica, belladonna, boneset, catmint, clover blossoms, elder blossoms, fireweed, gold thread, gravel plant, or trailing arbutus or Mayflower, henbane or night shade, horehound, sage, liverwort, squaw vine or partridge berry, pennyroyal, skull cap, balmony, thorn apple leaves, thyme, water pepper or smart weed and wintergreen.

Most of these plants grow wild, and there is little systematic effort to cultivate them, but here and there gardeners attempt to cultivate them in gardens and fields with fair success. Besides these mentioned, there are others that always sell well whether gathered from their wild state or cultivated in the garden. Among these, mention should be made of wormwood, motherwort, lemon and sweet balm, burdock root, comfrey root, yellow dock, hyssop, garden lettuce, marshmallow root, and the leaves of parsley, poppy, stramonium or thorn apple, Jamestown weed and stink weed, valerian, peppermint, spearmint, summer savory and rue.

There are many other herbs and plants which every large wholesale dealer must keep in stock, but which have not increased much in demand. They are only occasionally called for, and the demand is so limited that the wild plants supply the market easily. These are agrimony, angustura, sweet balsam, betony, borage, buck bean, bugle herb, bitter clover, cocash, dittany, haircap moss, lungwort, masterwort, milkweed, mugwort, yellow parilla, sometimes called Texas sarsaparilla, resin weed, scabish, vervain and yarrow.

Of late years ginseng has grown into favor in this country, and the herb gatherers of Tennessee, North Carolina and West Virginia make considerable in gathering it. Ginseng is shipped to China in large quantities, where it is generally accepted as possessing marvelous curative virtues. The trade in it is steady and will continue as long as the Chinese believe in its medicinal virtues. All through the Appalachian region ginseng abounds, and some is found in New Jersey, but the roots are being gathered so freely that the supply will in time run short. Attempts to cultivate ginseng in the South have so far failed, but with the right conditions there is no reason why it should not flourish in gardens or fields. There are probably a quarter of a million pounds of this root exported, and it is sold all the way from fifty cents to several dollars per pound, according to its quality. In China, the best ginseng comes from Manchuria, known as the "imperial," and is sold only to the wealthy, who frequently pay fabulous prices for it. The second grade is collected in Corea, while the ginseng used by the common and poorer classes is gathered in the United States. In China this latter sells from $2 to $5 a pound, while the "imperial" may bring $40, $50 and $100 a pound. The Chinese call ginseng "jen shan," and believe that only the most perfect grows in the Garden of the Gods, and that all else is merely an imitation. This superstition costs the Chinese many thousands of dollars, for, while the root has some medicinal value, it possesses no specially marvelous virtue.

Wonderful Things that are Near.

The Philadelphia Press foreshadows the coming of the millennium as follows:

Flying is solved. The principle is known. A mechanical expedient is all that is now needed to make it successful. Practical flight is to-day not more than five or ten years off.

A glow worm makes light with about one three-hundredth part of the force used in ordinary artificial light. When men know how to make light as cheap, streets and homes will be as light as day for a mere fraction of what light now costs. This is near. Vacuum illumination without incandescence is already in full operation, and in a year or two should cut down the price of light to a sixth of its current cost, and in five or ten years light may be, like water, turned on in every house at will.

Compressed air has long been known to be the best way, theoretically, to store force for use in transportation. There is no waste and no deterioration. The need is a cheap and efficient motor to apply compressed air to city transportation. If this can be done, first the trolley poles and wires will come down, next the horseless, compressed air motor carriage will do all the work of city delivery.

When these come the only use for gas will be for cooking—if this is not done by electricity. Factories, also, before many years, will be run by transmitted electric power. This has begun to be done and in five or ten years will be completed, and the factory fire and boiler will be a thing of the past.

The city of the future, and no very distant future, will have no trolley poles or wires and no horses. All movements will be on rail by silent air motors or by horseless carriages equally silent. All pavements will be asphalt. Unlimited light will be as cheap as unlimited water is to-day. No coal will be delivered at private houses and no ashes taken from them. With no horses, no coal and no ashes, street dust and dirt will be reduced to a minimum. With no factory fires and no kitchen or furnace fires, the air will be as pure in the city as in the country. Trees will have a chance; houses be warmed and lighted as easily and cheaply as they are now supplied with water.

A city will be a pretty nice place to live in when the first twenty years of the twentieth century are passed.

THE LONG DISTANCE TRANSMISSION PLANT AT FRESNO, CAL.

One of the latest and, in many respects, one of the most remarkable long distance transmission plants is that which has been built by the San Joaquin Electric Company to supply the town of Fresno with light and power. Nature has made abundant provision for furnishing electric power along the valleys of the Pacific coast, the many streams which flow down the Sierra and the Cascade Mountains providing an abundant and never failing supply of water for this purpose.

Fig. 8.—JUNCTION OF THE TWO DIVERSION FLUMES AT THE NORTH FORK—DITCH OF THE SOUTH BRANCH SEEN TO THE RIGHT.

Fresno is a thriving agricultural town of about 15,000 inhabitants, which lies in the midst of the far famed San Joaquin Valley, in Southern California. Founded about twenty-five years ago, its growth and present prosperity are due almost entirely to its agricultural interests. Manufacture on a large scale has been handicapped by the prohibitive cost of transportation and particularly by the high price of coal, which costs delivered in Fresno about $9 per ton.

Like many another town in the Sacramento and San Joaquin Valleys, Fresno has for many years looked with longing eyes to the magnificent water supply of the neighboring mountains, and the present transmission plant is the outcome of a very determined and equally successful effort on the part of the citizens which first took practical shape in the formation of the present company on April 2, 1895. The headwaters of the streams which supply the power are situated well up above the winter snow line, and the points of diversion from the north fork of the San Joaquin River and from a tributary known as the South Branch are about forty miles distant from Fresno. The water is taken from these rivers by wooden flumes of the usual construction, which are solidly bolted to the bed rock of the river to prevent their being washed away by the winter freshets.

They are fastened down by means of anchor bolts which are split open at the end and have a steel wedge inserted which, as the bolt is driven home in the rock, spreads out the metal and wedges it securely in place. Additional security is given by running melted lead into the holes. Two of our illustrations, Figs. 8 and 10, show the junction of the two flumes, at the north fork of the San Joaquin River.

The total length of the ditch is about seven miles, and of this some 3,000 feet is wooden flume. At every 4,000 feet of the distance there is a waste gate, one of which will be noticed in the illustration showing the junction of the diversion flumes. The ditch leads ultimately into a reservoir whose area is about eight acres. The site chosen for this work is a natural table land or plateau on the summit of Reservoir Mountain. The plateau is surrounded on three sides by rising ground, and on the fourth side it was merely necessary to throw up a ten foot embankment for a distance of about 500 feet. The reservoir has sufficient capacity to run the transmission plant for five and a half days. The pipe line, Fig. 1, leads from the reservoir down the side of the mountain to the power house, a distance of 4,000 feet, the total fall being 1,411 feet. The water is led into the pipe line through a series of bell-shaped mouths or openings, six feet in diameter, which are covered by a screen for preventing the passage of gravel and other debris. Water may be conveyed to the pipe line either directly from the ditch or the reservoir, the large admission gates being shown in Fig. 7.

The pipe line itself is built in three sections; the first, which is 1,820 feet long, consists of 24 inch riveted pipe, the first half being constructed of No. 12 steel, and the second half of steel ¼ of an inch thick. The second section contains 400 feet of welded pipe, which is 20 inches in diameter and lock jointed. The third section, 1,800 feet long, consists of 20 inch lap-welded pipe, with flange joints and rubber packing, the metal at the lower end being ⅝ inch in thickness.

The construction of the pipe line was commenced at both ends, and considerable difficulty was experienced in closing the gap at the center of the line. This was due to the alteration in length, resulting from the change of temperature. Before sunrise the opening was 7 feet 8 inches, but in the afternoon this gap would close to 7 feet, the change being due, of course, to expansion under the heat of the sun's rays. This difficulty was met by fitting a length of 20 inch lap-welded pipe to the adjoining ends of the pipe line before sunrise. The joint was leaded and calked, and the pipe filled with water before the heat could produce any expansion.

Some portions of the pipe line are laid from 5 to 8 feet underground; elsewhere it is carried on bridgework; but for the greater part of its length it is bolted to the solid rock. It is held in place by means of bolts, fastened in the manner above mentioned into the bed rock, the bolts having a screwed attachment to flat iron bands, ⅝ of an inch thick by 2½ inches wide, which pass over the top of the pipe. The pipe line terminates in a receiver, 30 inches in diameter and 57 feet long, which is secured over the wheel pit at the side of the power house, as shown in Figs. 3 and 5. The end thrust which comes upon the receiver is, of course, enormous, the pressure per square inch being 609 pounds, and the total thrust of the column of water no less than 93 tons. It is resisted by a heavy stone abutment, to which the receiver is attached by four heavy steel bolts, 2½ inches in diameter.

It is not surprising that in handling water under the enormous head of 1,411 feet some new and unexpected difficulties should have presented themselves. The greatest head with which engineers had hitherto been familiar was between 500 and 600 feet, but in the present case the head was between two and three times as great and the column of water was about 4,000 feet long and weighed about 317 tons. It might be said that in a certain sense the water lost its fluidity, and that when it issued from the 1⅛ inch nozzle at a speed of over 9,000 feet per minute it had some of the characteristics of a solid bar of metal. It was presumed that in the absence of any experience with a head of 1,400 feet it would be best to use large gates and relief valves of the same type as were used for a head of 500 and 600 feet. As a matter of fact, however, such was the great pressure upon them, and the resulting surface friction of the metal, that they proved to be quite inadequate.

Fig. 9.—DIVERSION FLUME FOR BRINGING WATER TO THE RESERVOIR.

With the gates at first installed, it was found that great difficulty and some measure of risk arose from the momentum of the column of water whenever the gates were opened or closed. The "water hammer" was sufficient to cause a fluctuation in the pressure of

THE LONG DISTANCE ELECTRIC POWER TRANSMISSION PLANT AT FRESNO, CALIFORNIA

90 pounds from the normal. Upon opening the gate the pressure would fall 90 pounds below the normal, then rise to 80 pounds above normal, dropping again to 75 pounds below normal, the fluctuation continuing for about half a minute, or until the normal pressure was reached. An attempt was then made to control the gates by hydraulic rams, the power being taken from the pipe line. The rams opened and closed the gates so expeditiously that a fluctuation in pressure of 170 pounds each way from the normal was recorded. To check the speed the exhaust outlets of the rams were reduced in size to $\frac{3}{16}$ of an inch—an arrangement which increased the time of opening or closing to half a minute, and reduced the variation of pressure to 30 pounds. The hydraulic gates were eventually discarded in favor of a set of gates which are operated by means of a hand wheel. These have proved very successful, and there has been no further trouble from water shock.

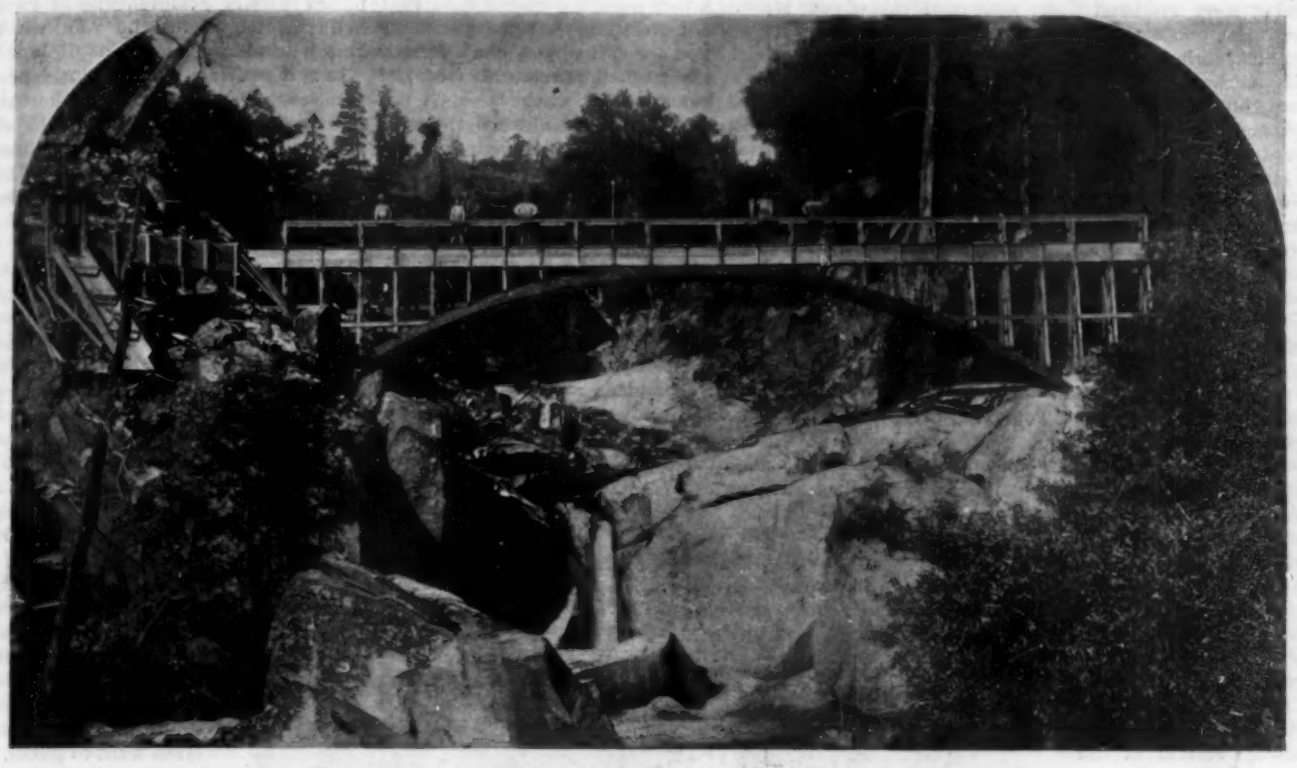


Fig. 10.—WOODEN ARCH FLUME ACROSS THE NORTH FORK OF THE SAN JOAQUIN RIVER.

THE LONG DISTANCE ELECTRIC POWER TRANSMISSION PLANT AT FRESNO, CALIFORNIA.

By reference to Figs. 3 and 5 it will be seen that the receiver is carried upon I beams which extend across the wheel pit. There are three single jet Pelton wheels for driving the generators, two for driving the exciters, and two smaller wheels which operate the governor mechanism. The main Pelton wheels are 57 inches in outside diameter and each wheel has 27 buckets. On the same shaft with the wheel is a three ton fly wheel, 5 feet in diameter, and as the speed of revolution is 600 per minute, the disruption of the fly wheel by centrifugal force is provided against by shrinking on a 2 inch steel band around its periphery. The enormous force of the water is shown by its behavior in the wheel pit. When the water was first turned on, instead of falling from the buckets into the tail race, it followed the wheels to the plank covering of the pit, along which it rushed, finally leaping out horizontally a distance of 60 feet. Where it struck the bottom of the pit, it tore up the concrete and attacked the underlying rock. A cushion pipe 14 inches diameter and 14 feet long was placed in line with the jet, but it merely reversed the direction of the water, which was spurted out upon the roof of the power house. The floor was then covered with $\frac{3}{8}$ inch steel plates, but the sand and fine gravel in the water cut through the plate. Finally, a $1\frac{1}{2}$ inch cast iron plate was placed at the point of impact, the idea being to replace it as soon as the water had worn it away.

The power house, which is a handsome structure of granite 36 feet in width by 70 feet long, contains three 340 K. W. multipolar General Electric 3-phase generators, which deliver current at 700 volts to a low potential switchboard, from which it is carried to six 125 K. W. transformers, which deliver 3-phase current at 11,000 volts through a high potential switchboard to the line. There are also two $12\frac{1}{2}$ K. W. multipolar exciters, each of which can take care of the whole plant. The transformers are of what is known as the air blast type. They are placed upon an inclosed platform, through which air is forced, issuing through holes in the floor and thence to ventilating ducts in the cores of the transformers themselves. The power house and the substation at Fresno are protected by lightning arresters and choke coils.

The pole line from the power house to the city is built of square sawed redwood poles 12 by 12 inches at the butt and 6 by 6 inches at the top, the length varying from 35 to 40 feet. The 11,000 volt circuit is made up of two 3-phase 3 wire sets of No. 3 B. & S. soft drawn copper. The insulators are arranged on two arms, there being four on the top arm, two on each side of the pole and two on the bottom arm, each of which is placed centrally beneath the two on the upper pole. It will be seen that the insulators thus form a triangle on each side of the pole, each triangle carrying one complete circuit. The insulators are of the well known "triple petticoat" type. They are of helmet shape, with a groove at the top and wings on each side, and the transmission wire is carried by the groove, which is tied to the wings by soft copper wire. The course of the line for ten miles is through a rolling country which is situated below the snow line and is easily accessible. From the foothills the line runs through the wheat fields and vineyards which are characteristic of this part of the valley.

At the substation at Fresno the line enters through choking coils, lightning arresters, and the high tension switchboard, which stands some eight feet above the floor. The choke coils are made up of 150 feet of insulated wire which is coiled into a ring and thoroughly taped. The self-induction of these rings obliges the lightning to take the required path. The current after leaving the switchboard is carried to step-down transformers, whose construction is similar to the step-up transformers at the power house. There are nine of these arranged in three sets. Three 125 K. W. transformers deliver current at 115 volts to the commercial incandescent circuits. Another set of three 75 K. W. transformers delivers current at 1,000 volts for operating the power circuits, and the third set of three 40 K. W. transformers delivers a 3,000 volt current for the suburban and outlying districts. A five horse power induction motor drives a blower which furnishes the air blast for cooling the transformers.

WATER MOCCASIN.

The San Joaquin Electric Company has established a price of $64 per horse power per year for its electric power. The current for lighting purposes is furnished at fifteen cents per K.W. hour, measured by meter, with discounts of from five to twenty-five per cent, or it is furnished at a fixed rate of from thirty cents per sixteen candle power lamp per month to ten cents per lamp for bedrooms, bathrooms, etc.

A visitor to the power house will be startled by the loud detonations which accompany the starting of the water wheels. The noise is described as being similar to a heavy bombardment by artillery, and to an inexperienced ear it would sound as though the whole plant were in danger of violent disruption. The explanation of these concussions is that the air which is collected in the receiver and the pipes is subject to the enormous pressure of 609 pounds to the square inch, and on its escaping from the nozzle in the form of bubbles it expands with an explosive force. So loud are the reverberations through the hills that the farmers who live six miles from the power house can tell the hour at which the water is being turned on. The total length of the work is forty-five miles. The length of the ditch, as before stated, is seven miles, and its capacity sixty cubic feet per second. The reservoir above the pipe line has a capacity of four million cubic feet, and covers an area of eight acres. Altogether there is a constant supply of water in sight sufficient to provide fully fifty thousand horse power to the city.

The plant has been in active operation since June 12, 1896, and is giving the very best of satisfaction. It is now supplying current for 165 arc lights, over 5,000 incandescent lamps, and 460 horse power in motors.

The original conception and the plans of this very successful work are due to Mr. John S. Eastwood, civil engineer of Fresno, to whom we are indebted for the photographs and data used in the preparation of the present article.

COLLECTORS OF SNAKES.

BY L. P. GRATACAP.

Human curiosity is excited by few subjects in the animal world more keenly than by snakes. The ancient associations of these singular creatures, the peculiar innate instinct of dread and repulsion aroused by them, and the deadly power possessed by a few genera among them contribute to make them perennial objects of interest. The popular feelings of alarm and fascination in their presence were vividly shown at the winter reception of the Microscopical Society at the American Museum of Natural History, where Mr. R. L. Dittmars, of this city, exhibited microscopical preparations of the fangs of rattlesnakes, and by way of ad captandum two glass covered boxes containing respectively a water moccasin and young and a copperhead and young. The breathless interest of the spectators, their incessant storm of inquiry, and the congested crowd that poured in and around the basilisk eyed reptiles were eloquent testimony to the peculiar attraction exerted by them upon the average visitor. The exhibition made by Mr. Dittmars was a very faint suggestion of the remarkable display which the favored guest of his hospitality may enjoy at his own home. In a room of moderate dimensions this collector has arranged his ophidian pets in lines of boxes with glass covers placed around the walls. A remarkable and rather startling effect is produced, one not altogether reassuring when the expectant visitor enters this singular domestic den of reptiles, and observes the excitement of the rattlesnakes, unpleasantly accentuated by the keen sibilant hum of their tail buttons.

Here a Florida diamond back rattler, a Goliath in strength and of monstrous size, rolls himself in ominous coils, and with depressed nostrils and erect rattle seems the impersonation of stifled fury, his sinister expression giving a frightful ferocity from the glittering eyes and the singularly expressive sculpture and markings of his broad head. The delicate and featherlike scales over his body impart to it a softness and velvet beauty which accentuates the fiendlike bitterness of his aspect. There a number of Texan rattlers are twisted into a graceful group, bristling with alert heads and sonorous with the peculiar sharp whirr of their vibrating tails. Another case shows a torpid mass of water moccasins. Their careless attention, as the visitor approaches, seems more reassuring, but though less nervously irritable, their bite is almost as venomous as that of the rattler, and their rage and gloating rapacity, when they seize their prey, more terrifying.

The banded rattlesnake (Crotalus horridus) of this latitude is represented by a number of smaller specimens, gathered, almost picturesquely, about their water tub or stretched indolently over a few stones, while

their diminutive rattles seem scarcely responsive to the provocation of a gesture or a blow. A large copperhead snake (Agkistrodon contortrix), curiously observant, but motionless, is extended in another case, his faintly rubescent tint and impassive attitude increasing his resemblance to a metallic cast.

Less threatening are the numerous groups and individuals of the non-poisonous species, whose long familiarity with handling have rendered them tame and gentle. They are taken out by Mr. Dittmars and, enwreathed around him, form living festoons of slowly undulating bands marked by party-colored stains, blotches, squares or lines, emitting with lightninglike rapidity their delicate forked tongues.

The beautiful red corn snake of more southern latitudes, the long black chicken snake, the pest of henroosts in the South, the agile and belligerent black snake of our swamps and woods, the exquisitely colored green snake found more to the north, the highly colored hog-nose snake with its inflated neck and mimicry of menace and attack, the many species of garter snake, from those of the Mojave Desert to the lithe and variegated ribbon snakes of our fields and hillsides; the singular milk snake, over whose variations in markings Dr. Cope has exhausted his searching analyses; the vivid pine snake, the fox and water snakes, compose a garland of novelty and interest.

Mr. Boulenger, who has recently completed the catalogue of snakes in the British Museum, a work of extraordinary pains, recognizes 1,639 species, which he divides among nine families. First in this systematic arrangement come the wormlike Typhlopidae living in burrows under the earth, and numerous in the tropics. Allied in habits are the Glauconiidae, and then the huge pythons and boas, with an intermediate section of the Ilysiidae with only five species, two East Indian genera and one South American. The Uropeltidae follow, the whole of whose forty-two species are confined to Ceylon and India, where they are found in the tea and coffee fields. Mr. Boulenger limits the sixth family to one genus and species, Xenopeltis unicolor, of India and Malay. The seventh family is the Colubridae, the most extensive of all, comprising the more common of our snakes. This enormous family has been separated into three parallel series, the first with solid teeth, the second with the hinder teeth on the jaw (maxillary) grooved, and the third with the forward maxillaries grooved. The first comprise (Aglypha) harmless snakes, the second (Opisthoglypha) suspicious, more or less poisonous species, the last (Proteroglypha) venomous groups. The typical poisonous snakes are placed in the Viperidae, the ninth family. Here rest the copperhead, rattlesnake, cobra, fer de lance, etc. The eighth family, Amblycephalidae, have non-extensile jaws and feed on insects. The erectile teeth belong to the true vipers, and it is interesting to observe the fang or tooth of the rattlesnake, disclosed from its membranous sheath, and forced by pressure upon some solid object, exude the deadly liquid so mysteriously fatal.

Mr. Dittmars has been engaged with Dr. Langman, of this city, in procuring, from a vigorous and large collection of snakes, belonging to the latter, samples of the venom of water moccasins, rattlesnakes and copperheads. This is furnished to the laboratory at Heidelberg for analysis in continuation or confirmation of the studies of Weir Mitchell and Calmette.

However strong the sense of abhorrence may be awakened in some in the presence of these reptiles, it would, upon familiarity, rapidly disappear, and it would in most cases be succeeded by a real affection for the many graceful and harmless species.

Mr. Dittmars is not alone in his attachment to this neglected section of the zoological series. Prof. G. R. O'Reilly, Mr. Charles H. Higby, Mr. Gustav Von Moser, and Dr. G. Langman, all of this city, also keep collections, and become deeply attached to their ophidian pets, or, in the case of the vipers, find them full of interest.

THE habit of dressing too warmly within doors in the winter season is earnestly deprecated by physicians. The temperature of modern houses and offices is usually about 70 deg., which is summer heat. Yet both sexes select thick flannels and heavy dresses and coats for house wear and then go out into an atmosphere many degrees colder, with little additional protection, especially for the feet. This is a fruitful source of colds.

Breathe Properly.

Do you know what an "active chest" is? Probably not, answers a writer in the New York Tribune; but your chest ought to be active—that is, lifted up—two-thirds of the time you are awake. Stand up and take a long breath, as long as you can; now you lift your chest; keep your chest up while you go on breathing by movement of the abdomen and the muscles at the side of your waist. A very slight movement is all that is necessary for normal breathing; but now you have let your chest fall! You are so tired you can't hold it up! That shows a very bad, unnatural state of things; the normal human being, whenever he is not relaxed, walks with his chest up; and when he talks with vigor or interest, it is with his chest up; and you can't hold yours up three minutes without fatigue—you can't do it, at all, for five! Do you know that the preservation or achievement of a round, slender waist will be your reward if you will strengthen your muscles and learn to keep your chest up? It will certainly, except as you become hopelessly fat, and even then good breathing will do much to preserve some good outlines in your figure. Proper breathing and the habit of keeping the chest up will keep all the internal organs in their proper place and keep them from spreading the waist in any way that is unsightly, and shows not Greek health, but deficient vitality. The first thing is to get so you can hold the chest up. Walk across the floor three times, holding up your chest (just as you do when you try to fasten a tight skirtband), at the same time breathing deeply from the abdomen. After the three times you are exhausted; rest and try it again; to-morrow you can perhaps do it four; don't tire yourself, but keep at it till you have strengthened the muscles that hold your chest up just as you would strengthen the muscles of your arms, with use. Always practice out-of-doors or with your windows up; there are many good breathing exercises and but few can very well be conveyed in print, but the main thing is very simple; breathe with your chest up, and keep on doing so till you do it naturally, all the time that you are not relaxed in rest.

One good exercise that can be taught is to simply stand and take as long a breath as you can, chest well up, and then hold it as long as you can. This exercise used for a few minutes every day is most beneficial, and physicians recommend it for strengthening and expanding the lungs.

Professor Tyndall said that, as a broad general rule, any air out of doors was better than any air indoors. Breathing exercises are most effective outside the house and generally they are not conspicuous even on a city sidewalk.

QUEEN WILHELMINA OF HOLLAND.

THE QUEEN OF HOLLAND.

Of the two child monarchs who have been ruling in Europe of late years—the King of Spain and the Queen of Holland—it is of the young queen that the world at large has heard the most. And indeed it is with her that the world has the more sympathy, for she is the last of the House of Orange, a house made famous three hundred years ago through the bold and determined military achievements of its greatest member, William the Silent—the "Father William" of the Dutch people.

It is a rather striking coincidence that now, after three centuries have elapsed, the thrones of Holland and Spain should both be held by children, and that these children should be, too, the lineal descendants of those most bitter enemies, Philip II and William the Silent; the former the would be destroyer of Dutch civil and religious liberty, the latter the founder and maintainer of it. Though he died a martyr to the cause—for the assassin's knife directed by Philip ended his splendid career—William's life and example so inspired the Hollanders that they were able to keep up the fight until, over twenty years later (in 1609), Spain gave up the contest and the United Provinces of the Netherlands were freed from the yoke of ecclesiastical and civil despotism, against which they had fought for thirty-seven years. This struggle was one of the most heroic and hard fought struggles for liberty the world has ever seen. A nation with less persistency than the Dutch could never have won it.

During the centuries since the separation of the United Provinces from Spain, that particular part of the Low Countries known as Holland has passed through many vicissitudes of government. In the first half of the present century the Republic of the Netherlands went to pieces, and the separate kingdoms of Holland and Belgium were formed out of it; so that at the present time Holland is a limited monarchy having two law making houses much like those of the English Parliament.

Wilhelmina Helena Pauline Maria, the young Queen, was born on the 31st of August, 1880; consequently, she will attain her majority and be pronounced ruling sovereign a year from the last day of August next.

King William III, the father of the Queen, spent the best part of his life in wild dissipation, and developed a character altogether unsavory. In 1839 he married Princess Sophia, of Saxony. He was then Prince of Orange, but after a half score of years had passed he became King, and the fortune left him turned his head. He plunged into all sorts of dissipation, and finally alienated himself from his queen, whom he falsely accused of plotting with the Emperor Napoleon to depose him, and set her up as Queen Regent. So bitter became his hatred of his first Queen that, even when she was on her death bed, he refused to see her. Of the two sons whom he had by this marriage, the elder, the Prince of Orange, ruined his health and died after a few years of reckless life in Paris; the second son, Prince Alexander, who was of a gloomy and unsound mind, soon followed his brother to the grave; and left now without an heir, the fast aging King began to look about for another wife, that he might not die childless. He finally determined on the Duchess of Albany, a daughter of the Prince of Waldeck-Pyrmont, for his second queen, but she, unfortunately, did not fancy the decrepit old King for a husband. She was a young woman of twenty-two, and could hardly be blamed. It is said that when Queen Emma heard her sister refuse the King's offer of marriage she said to her, "Helen, I should never refuse to become a queen." The King happened to overhear the remark and was so pleased with the younger sister Emma—a girl of but nineteen—that he addressed his offer of marriage to her, and she, true to her word, did not refuse. So it came about that this lively young maid returned with King William to The Hague and became his beloved queen, nursing him tenderly through the long, painful years that remained to him of life. He lived to see his little daughter reach the age of ten years; and a few years before his death, at a council of the States-General, he obtained the setting aside of the Salic law, which forbade a female heir to succeed to the throne. So, upon her father's death, Wilhelmina became Queen, and her mother, whom she resembles in many respects, was appointed Queen Regent.

The little Queen was of a most delicate constitution during her early years, and grave doubts were at one

time entertained as to whether she would reach womanhood; but, under the careful tutelage of her wise mother, she has developed into a healthy, lovable girl; and that she has completely won the hearts of her people, you have only to question the average Dutchman concerning her to learn.

As she is approaching the marriageable age, the question naturally arises whom she will select to be Prince Consort. Rumors are abroad to the effect that Wilhelmina is already betrothed to Prince Bernard Henry, a grandson of the Grand Duke of Saxe-Weimar-Eisenbach, who wedded a sister of William III. Should such an alliance take place, it is questionable whether it would be liked by the Dutch people, for they have no very friendly feelings toward the Germans, who, it would seem, are only waiting for a favorable chance to absorb Holland in the German confederation. Germany, however, being the Queen Regent Emma's natal land, she may very naturally wish her daughter to go there for a husband. Still, she undoubtedly has the Dutch people's interest at heart, and can be relied upon to make or sanction no alliance which would be distasteful to them. As for the Queen herself—and surely she, more than anyone else, is concerned in the matter—she says she will have no marriage for diplomacy merely; the man she weds must love her deeply and be loved in return, or she will have none of him. Herein she shows a spirit that an American girl will appreciate. She is said, among other things, to have a will of her own, and an incident illustrative of this, which has been widely told, is as follows: When, some few years ago, the German Emperor was making a formal visit to The Hague, Queen Wilhelmina expressed her intention to attend the state banquet. After considerable argument with her mother on the subject, the latter was forced to conduct the young lady to her bedroom, where, as the Queen Regent was about to leave, she rose upon her dignity and said: "I will go on the balcony and tell the Dutch people how you abuse their Queen." Of course, she did not carry out her threat, and the next morning she was sorry for her rash words; but the incident illustrates her strength of will and a determination not to be abused. Wilhelmina has a gentle though firm disposition, and when she ascends the throne as actual ruler it is to be hoped that she will have as great an influence in the purification of the court after the dissolute reign of her father as did Victoria of England upon the court of that country when she succeeded to the throne.

For the excellent portrait of the young Queen, which we present herewith, we have to thank the photographer to the Queen, Kameke, whose finely equipped studio at The Hague is visited often by Americans, and who himself has received deserved recognition for the exquisite aquarelles he produces.

Errors of Instinct.

That instinct is not infallible we are assured by M. A. Acloque, who gives in La Nature (Paris, November 14) some interesting instances of the truth of his assertion. The Literary Digest translates part of his article below:

"It may be stated that instinctive impulses are in some degree determined in advance for each species, and in correlation with the different acts that the individual is called upon to accomplish by reason of its own mode of life. Accordingly it is a legitimate conclusion that animals may sometimes be deceived, when the problem that they are called on to solve does not present itself under normal conditions, or when the circumstances in which they are placed are only apparently true. This is in fact what actually happens, and we believe that it will be interesting to cite several examples where instinct, thus confronted—accidentally or experimentally—with unaccustomed or artificial conditions, finds itself at fault.

"The Spegians are a tribe of wasps that make their nests in the earth and provision these nests, where they deposit their eggs, with the larvæ of other insects, particularly caterpillars, . . . or even with spiders. These wasps do not kill their victims; they are satisfied with paralyzing them. For the young larva that will issue from each of the eggs has delicate tastes, and would not be willing to feed on partially decayed flesh. Thus each victim is pierced with the sting, which finds its way to a nerve ganglion . . . and inoculates the prey—to use the technical term—with a drop of poison endowed with anæsthetic properties. This poison condemns the victim to the most absolute immobility, and it thus falls an easy prey to the newly born larva.

"One southern species, the yellow winged Sphex, provisions its nests with a large cricket, which it knows how to wound in the exact spot necessary to prevent all resistance, and which it drags, not without difficulty, to its nest. This Sphex is an interesting study. When it has got its cricket to the edge of its nest, it never fails to go into the gallery, doubtless for fear lest some intruder might profit by its work, and never brings in its prey without going through this prudent domiciliary visitation. If the cricket be removed and placed some distance away, the Sphex, after finding it, brings it anew to the opening, and repeats its inspection of its lodgings. This happens as often as the observer pleases to repeat the experiment. If now the cricket be taken away altogether, the Sphex at first shows great anxiety, turns around, and rushes here and there, not understanding the trick that has been played it. Finally, recognizing that its efforts are futile, it returns to its burrow and sets to work conscientiously to seal up the opening, as if the cricket were within. In doing thus it performs all the acts imposed on it by its instinct to assure, under normal conditions, the nourishment of its larva. Only instinct, since it did not foresee the case of an accidental intervention that should cause the prey to disappear, did not indicate any solution of the problem thus propounded by chance. And the insect, being confused, does a foolish thing."

Natural and Acquired Immunity.

The natural immunity of many animals to certain diseases, even when the actual virus is injected, has long been known, and various explanations have been given. Quite recently careful investigations have been carried out by MM. Calmette and Delarde in the Pasteur Institute at Lille. In their experiments they made use of the following poisons, viz., an animal virus, serpent's venom, and a vegetable poison, abrine, prepared by macerating jequirity seeds (Abrus precatorius) in water. They found that the immunity of pigs and hedgehogs to venom and of fowls and tortoises to abrine could not be due to the presence of antitoxins in the blood previously to inoculation, for the serum of the normal animals had no protective effect on susceptible animals, nor had it any neutralizing effect on the poison when mixed with it outside the body before inoculation, in both these respects differing from serum containing antitoxins. They were also unable to discover any antitoxic substance in the brain, liver, spleen, or other organs of the normal animals. They hold, therefore, that the antitoxic serum is independent of immunity, since that may exist when no antitoxic properties are possessed by the serum. They attribute both kinds of immunity to special characters of the cells of the body.—Lancet.

ILLUMINATING values of mantles made from the following oxides per cubic foot of gas: Thoria, commercial, 6·0; thoria, pure, 1·0; zirconia, commercial 3·10; pure, 1·5; ceria, 0·9; yttria, 5·2; lanthania, 6·0; erbia, commercial, 1·70; pure, 0·6; alumina, 0·6. Ceria gives a reddish-yellow light; erbia, zirconia and barium a yellow light; alumina a whitish yellow.

RECENTLY PATENTED INVENTIONS.

Engineering.

SMOKE CONSUMING FURNACE.—Charles Groll, Roubaix, France. This furnace has a rotary grate and a fuel feeder comprising a series of superposed inclined partitions, terminating at different points of the grate, a tube or channel supplying fresh air through nozzles into the combustion chamber. The operation is methodized to get the fresh coal always on coal which is incandescent, to increase the length of the course followed by the gases in the combustion chamber, and conduct them successively from the coolest to the hottest portion of the fuel. The automatic coal feeder consists of a conveying worm and cylinder with apertures which distribute the coal into chutes leading to partitions one above the other in a channel placed radially with respect to the grate.

METALLURGICAL FURNACE.—William J. Thomas, deceased (Hannah Thomas, administratrix), Canal Dover, Ohio. This is a form of furnace adapted for glass melting, steel making, etc. It has two hearths, at the outer sides of which are gas flues and air flues, while there are chills or air spaces below and alongside the hearths, and between them is a main or central gas flue. It is designed in operation that the air and gas in the outer flues shall be reversed about every twenty or thirty minutes, and the gas in the central flue also reversed, along with the draught of the furnace to the stack, the perfect combustion at the top of the central flue carrying the heat through the hearth on either side as reversed.

VALVE GEAR.—Franklin Pilkington, Anniston, Ala. This gear comprises a rocker arm controlled from the governor eccentric, a yoke on the arm being controlled from the shaft eccentric, while a lever fulcrumed in the yoke controls the slide valve and a link connects the lever with the yoke. The improved gear is not liable to get out of order, affords a variable automatic cutoff, according to the speed of the engine, and a constant closing and opening of the exhaust at the proper time to produce highly economical results with but a single valve.

LUBRICATOR.—John C. Bauer, Remsen, Iowa. This is an automatic device for feeding oil to the cylinder or other parts of a locomotive or traction engine, preventing the oil from getting cold and sticky and feeding it in a uniform and reliable manner. The oil receiver is surrounded by a steam jacket, and the feeding of the oil is effected by steam pressure, its passage being regulated in drops by a needle valve oil regulator.

Railway Appliances.

AIR BRAKE HOSE COUPLING.—Ernest W. Shortridge, Kenova, West Va. This coupling comprises two sections, each having a longitudinal duct communicating with a flexible tubing, and the coupling is so arranged that, should a train become accidentally separated, the longitudinal movement of separating the sections would rotate a valve to prevent the escape of air from the forward section of the train, which would thus be left under the control of the engineer, while the air escaping from the rear section would operate the brakes of the detached section of the train.

RAILWAY SPIKE.—Jens K. Knudsen, Engadine, Mich. The body of this spike has an indentation in one side near the point, and a pliable prong is formed integral with the body and lies normally at its side, the free end of the prong being pointed and curved to lie within the indentation. As the spike is driven the prong diverges from the body portion of the spike and projects through the side of the tie against which it is clinched, rendering it impossible for it to work loose, although it may be readily withdrawn on bending back the clinched point.

Electrical.

DYNAMO AND MOTOR.—Charles P. Turner, New York City. As the magnetic permeability of iron in the field magnet cores of dynamos and motors is affected by the presence of carbon, phosphorus, and other impurities, and the alloying of iron with other metals also causes losses, this invention provides for the combination with the polar extremities of the cast or wrought iron field magnet of a facing of pure iron on the surface adjacent to the armature. The polar extremities are formed with an opening enough larger than the armature to allow for the electrolytic deposit on the concave surfaces adjoining the armature of a coating of pure iron, thus increasing the efficiency of the dynamo or motor.

ANNEALING APPARATUS.—The above inventor has also devised an apparatus for electrically annealing wire, etc., instead of employing an annealing furnace, as heretofore. The invention provides devices for feeding the wire over contact plates connected with an electric current generator, and means for subjecting the wire successively to the action of water, dilute acid, and water, after passing over the contact plates, whereby the wire is cooled and sealed, pickled, and the acid washed from its surface. The contact plates are adjustable to give the desired resistance to the electricity and insure a proper heating of the part of the wire between the plates, according to the strength of the current and the thickness and nature of the wire, which may thus be annealed to a perfectly uniform quality throughout.

ELECTROLYTICAL APPARATUS.—A further patent of Mr. Turner provides for the electrolytical separation of precious metals from the ore without mixing the gangue with the electrolyte, the apparatus being simple and durable in construction. It comprises a tank adapted to contain the electrolyte and provided with an electrode, a transversely partitioned receptacle containing the ore being set in the tank, the receptacle having perforated walls and being made of a non-conducting fabric coated with a conducting substance which is connected with a source of electrical supply to form the other electrode.

COMBINATION BATTERY CELL.—Henry A. C. Anderson, New York City. The zinc cup constituting the positive electrode of the cell is made with a number of apertures, according to this invention, whereby the cell, after its effective term of service as a dry cell has expired, may be revivified and used as a wet cell, it being simply necessary to place the cell in a cup or other receptacle containing a solution of sal ammoniac or other exciting liquid, such double use being due solely to the aperturing of the zinc cup.

ELECTRIC SWITCH.—William W. Doty, New York, and James A. MacKnight, Mount Vernon, N. Y. This invention provides a simple, durable and wholly automatic switch for street car and surface roads, which may be readily controlled by the operator in charge of an approaching car to set the switch according to the intended direction of the car. A pair of solenoids is connected with the switch point and adapted to be alternately energized by a current under the control of the operator on the car. The devices are not liable to get out of order, and moisture is not apt to interfere with the proper working of the parts.

TRAIN CONTROLLING DEVICE.—Christopher A. Shea, Milton, Mass. To automatically set the brakes on a train, should there be danger on a portion of the track section ahead of the train, this inventor has devised a novel arrangement of a circuit to be automatically controlled to release certain brake operating devices. The track circuit consists of the two rails connected by resistance coils and a short auxiliary contact rail, while a contact lever is carried by the train, and electric mechanism connected with the air brake valve lever, whereby the brakes are operated by the opening or short circuiting of the train or track circuit.

Mechanical.

RULING MACHINE.—Charles Stoll, Chicago, Ill. This invention provides novel means by which a double ruling attachment may be readily connected with or disconnected from the ordinary mechanism of a single ruling machine, enabling it to do single or double ruling at will. The invention comprises an auxiliary frame with rollers and cords co-operating to secure the reversal of the paper, a ruling device being carried on the frame, and there being pivoted arms by which the auxiliary frame may be raised clear of the main frame, and means by which the roller carrying the back strings may be shifted between the main and the auxiliary frames.

SAWING MACHINE.—Albert C. Calkins, Santa Barbara, Cal. This machine comprises a vertically adjustable frame supported on upright guides, a yoke forming the lower part of the frame and a block sliding in guides being supported in its upper part, while a pendulum rod is pivoted at its upper end to the block and at its lower end to the saw frame. The saw is lowered as the log is being cut, and in all positions the saw has a straight line motion, the saw being operated by a wheel, crank or other power device.

LEATHER WASHING MACHINE.—James McKenzie and Charles O. Shaw, Cheboygan, Mich. In this machine revoluble brushes are located one above the other, the shafts of the brush cylinders being revolved by intermeshing gear wheels, and the leather to be washed is fed between the brushes by feed rolls, the arrangement being such that the leather may be passed in and drawn back from between the brushes, without much strain on the working parts of the machine or much exertion on the part of the operator.

Agricultural.

STOCK WATERING.—Reuben G. Fay, Harlan, Iowa. To facilitate the watering of stock, this inventor has devised a novel connection between the permanent tank or reservoir and the trough, whereby the water in the trough will always be automatically kept at the required level. The invention comprises a valve casing supporting an arm through which the stem of the valve passes, there being a pulley adjacent to the arm and a float connected with the valve stem. The device is simple and inexpensive and may be readily applied to any form of trough or water reservoir, no matter how far they may be separated from each other.

Miscellaneous.

BICYCLE SADDLE.—In a design patent granted to Charles H. Young, M.D., 160 West Forty-eighth Street, New York City, for a bicycle saddle, special features of form are shown. The saddle is anatomical in all its parts, presenting concave surfaces that accurately fit the convexities of the buttocks and perineum, thereby preventing injurious pressure on these parts in both sexes. Whether made of leather or other material, the saddle is sustained in the shape best suited to the curves, upon a spring frame adapted to conform thereto. It should be made in different grades to easily fit persons of all ages, so that the curves are proportionate to the size, rendering the saddle always perfect, easy and comfortable to the rider. Manufacturers and others interested may obtain further particulars by addressing Dr. Young as above.

BICYCLE SUPPORT.—Thomas Jefferson, Spearfish, South Dakota. This is a device adapted to be carried on the frame of the bicycle and readily swung down to engage the ground and hold the wheel erect when the rider dismounts. It comprises a cross bar which centrally engages the frame, and having at its ends casings in which are pivoted arms adapted to be raised and lowered and locked in either position. The device is very light, strong and inexpensive, and forms a most convenient attachment to a wheel.

BICYCLE BRAKE.—Frank J. Coombs, Columbia Falls, Montana. According to this improvement, there is a pedal sleeve on the pedal shaft and cams are carried by the shaft and sleeve, on which a ring-shaped sprocket wheel is loosely mounted, brake shoes being movable into engagement with the wheel by means of cams, while spring impelled dogs carried by the shoes

are adapted to engage with shoulders in the wheel. The device is wholly hidden from view and protected from dirt and dust, and the brake may be applied by the pressure of the rider's feet on the foot pedals.

BICYCLE CANOPY.—Adolph Mass, Carbondale, Pa. This invention provides a light and simple canopy, which adds but a trifle to the weight of the machine and which may be folded up when not required and compactly strapped to the frame. The upright is adjustable in a standard attached to the frame, and has a swivel connection with the forward portion of the canopy, the latter being adjustable vertically or laterally, and so shaped and supported that it will automatically shift its position to face the wind edge on, returning to normal position as the wind dies out.

SAIL ATTACHMENT FOR BICYCLES.—Thomas Lotherington, Ardmore, Indian Territory. According to this invention a spring roller mounted in a slotted casing carries a sail which is secured to a gaff hinged to the casing, and adapted to close the slot when the sail is wound on the roller. The sail casings are readily attachable to the frame of the machine, without injuring its appearance, and the sails may be readily spread to take advantage of the wind to assist propulsion, or automatically withdrawn and furled in the casings.

TYPEWRITER AND ADDING MACHINE.—Jacob C. Wolfe, New York City. This invention is for an attachment applicable to any typewriter, to be acted upon by the numeral keys of the machine, the device carrying an adding mechanism whereby, as the figures in a column or line are printed by the machine, the sum total appears upon the adding mechanism, having been added simultaneously with the printing of the figures. The attachment, when not in use, may remain as a fixture on the machine and not interfere with its ordinary working, being conveniently brought into action when required.

RULER AND TIME COMPUTER.—Moses Isaacs, New York City. This is a device more especially designed for banks and brokers offices, to show the due dates of time paper, while also adapted for use as a ruler. Extending in longitudinal grooves around the ruler is a tape on which are printed the months and days, and the surface of the ruler is provided with a setting mark and marks indicating different times for which due papers may be drawn. The date band is wholly exposed on the sides of the ruler, and is easily moved along in its groove.

ELEVATOR PLATFORM.—Alphonzo E. Pelham, New York City. This inventor has devised a platform of simple and durable construction, more especially designed for elevators carrying hods and a wheelbarrow, as well as other articles and passengers. It has a top, with clutches adapted to grip the guide posts on the breaking of the cable, friction rollers bearing on the guide posts, while the platform castings have integral slides engaging the guide posts and bearings for the shafts of the clutches and the friction rollers, the castings also forming a support for the top or cover.

MIXING AND HEATING APPARATUS.—Augustus S. Cooper, Santa Barbara, Cal. This apparatus has a rotary drum formed of two intercommunicating and connected cones, the drum being mounted on an inclined axis and there being a spiral blade in the longer cone. When the drum is turned in one direction the blade forces the material toward one end of the drum, and when turned in the opposite direction the material is forced toward the other end. The drum is suspended in a furnace on hollow trunnions, one trunnion considerably higher than the other, the material being fed in through the upper trunnion and discharged through the lower one. The material is thoroughly agitated during the whole progress of the operation.

GAS REGULATOR FOR WELSBACH BURNERS.—Oren R. Cline, El Dorado, Kansas. To insure an even gas pressure, so that the variations in the flow may not injuriously effect the fragile mantle, this inventor has devised an automatic regulating valve in combination with the burner tube and the encompassing air chamber. The valve is placed in the burner between the initial pressure and the air chamber, and consists of a liquid seal chamber with central opening, an inverted cap with perforated top, while a valve stem attached to the cap descends through the seal and is attached at its lower end to the valve. If a portion of the lights be turned on or off, no change is effected in the feed of gas, a uniform light being always assured.

FIREPLACE.—Franklin E. Humphreys, Mason City, Iowa. According to this improvement, hot air flues extend up by the smoke flue to heat the upper rooms of the house, and the fresh air is supplied by a flue descending alongside the chimney, there being hot air spaces in close proximity to the grate, while the combustion is promoted by what is termed an oxygen burner, which consists principally of an adjustable perforated tube, connected with the grate and the air inlet, and by means of which the flow and distribution of the air may be most effectively regulated.

STOVEPIPE COUPLING.—Thomas Holland, Spokane, Washington. To positively lock together the ends of stovepipe sections, and also for conveniently locking the upper section to the flue, the adjacent ends of the sections, according to this invention, are apertured and connected together by a simple form of coupling plate or bar, the coupling plate being attached by pins entering the registering apertures and a screw. The uppermost or outer pipe section is locked in place by a pin entering a recess in the flue.

VAPOR BATH AND INHALING APPARATUS.—Charles W. Draper, Herington, Kansas. This invention provides means for giving vapor baths in which the patient is placed within a cabinet for vapor treatment, the head of the patient being exterior to the cabinet, to be treated by any desired nozzle, while the body is subjected to hot air or vapor treatment. The generator is placed at the side of the cabinet, and controlled by the doctor.

VENETIAN BLIND.—Charles L. Miller, New York City. According to this improvement a drum is adapted to wind or unwind a cord, the drum carrying a pinion in mesh with internal gear teeth on a revolubile eccentric, also formed with external gear teeth rolling off on a fixed internal gear wheel. The device is very simple and easily operated to raise or lower or turn the slats to any desired angle.

CHILD'S CARRIAGE.—Arabella J. M. Hurdle, Southampton, England. The especial object of this invention is to enable the handles of the carriage to be readily adjusted to any required angle to suit the height of the person propelling it, the body of the carriage being kept approximately horizontal. The joint is made by a shoe having cheek pieces with angular openings in which fit the angular ends of an apertured cylinder, there being also a second shoe through the cheek pieces of which and the cylinder a bolt passes, while a strap secured to the second shoe passes around the cylinder and a pivoted lever engages the free end of the strap.

GUITAR, ETC.—Czar Prince, New York City. This invention provides, for guitars and similar instruments, an improved capo tasto attachment for raising the pitch of all the strings. The capo tasto is composed of a support in which rocks a bridge carrier having seats for the spring, the spring engaging the seats to hold the carrier in either of its two positions. With this improvement the key of the instrument can be easily changed.

MITTEN OR LIKE FABRIC.—Isaac W. Lamb, Perry, Mich. In producing knitted fabrics in ribbed work, this invention provides means whereby the blanks may be cheaply and readily made and united to form the hand and receive the thumb. The invention consists principally in extending the selvedge yarns of one ribbed fabric between the front and back loops of the selvedge of the other fabric to form the two fabrics into one piece.

WINDOW CLEANING DEVICE.—John F. Girtler, Brooklyn, N. Y. To guard against one falling out of a window while cleaning it, this inventor has devised a safety device comprising a belt with which shoulder straps are permanently connected at one end and removably connected at their other ends, cords having hooked members on their forked ends and some of the hooks connecting with the shoulder straps, while keepers to be fixed to the window casing are engaged by the hooks. The device is simple and inexpensive, readily attached to the person, and may be conveniently connected with the keepers on the window casing.

SOUNDING BOARD.—James C. Livingston, Little Falls, N. Y. This is an improvement designed to insure a fine quality of tone in pianos and other instruments, both in the treble and bass, by a novel arrangement of hard and soft grained wood in the board, at the same time making it possible to utilize short pieces of valuable hard grain board lumber heretofore wasted. The improvement consists principally in making the board in its treble portion of hard grained strips of wood, while its base is made of soft and wider grained strips, whereby both the upper and lower notes are brought out more distinctly and purer.

COOKING STOVE.—James H. Fizer, Lexington, Ky. In this stove there is an inclined back plate for the fire chamber at a little distance in advance of the vertical front wall of the oven, the top of the back plate leaning against the upper edge of the oven wall, a damper controlling an opening in the lower part of the upright partition, and a damper controlling an opening at the front of a horizontal flue below the oven. The hot air chamber thus provided between the oven and fire pot, with the arrangement of the draughts, is designed to insure an even heating of the oven with but small consumption of fuel.

PIPE CLEANING APPARATUS.—Jacob Fierz, New York City. To clean rancid and ropy deposits from pipes used to dispense beer and other malt liquors, this inventor provides a cask in which is held a chemical or cleansing liquid, and with which connections are so made to the several pipes that, by opening the proper valve, air under pressure will force the cleansing liquid through the pipes, after which, by opening other valves, clean water will be likewise passed under pressure through the pipes, removing all traces of the chemical wash.

FILTER.—Edward Wolford, Ellwood City, Pa. This filter is made with a conical shell and inner similar-shaped filtering medium, the bottom of the shell being closed by a cap, and a brush-carrying shaft having sliding and rotary movement in the casing, contacting with the faces of the shell and the filtering material. This shaft is revolved by a crank at the top of the casing to clean the shell and filtering material, the impurities then flowing out through a faucet specially provided for their exit, but which is closed when water is to be withdrawn through the filtered water faucet.

SORTING TABLE.—Edmond F. B. Bourne, Vancouver, Canada. To facilitate the assorting of mail matter, this inventor has devised a table which takes up but little space and yet will accommodate a considerable number of sorters, the sorting divisions being quickly and easily changed. The table has a ring-shaped top having inward and outward upwardly extended flanges, a number of radially disposed supporting walls, and means for removably securing the inner edges of the walls together.

DIAPER FASTENER AND SUPPORTER.—Lizzie G. Scully, Rome, N. Y. This device comprises an elastic band with button on one end to engage a loop on a baby's garment, there being also other elastic bands adapted to engage the button, and a locking plate whereby the diaper will be held as adjusted without the use of safety pins.

CORSET FASTENER.—Carlton H. Merrill, Troy, N. Y. This is a simple, strong, cheaply manufactured device, not liable to get out of order, and enables the wearer to simultaneously manipulate the several fastening devices to open and close the edges of the corset. The invention consists of three busks, of which one is movable, the second carries studs, and the third is provided with a rigid jaw pivotally connected with a movable jaw fulcrumed on the movable busk, the jaws being adapted to engage the studs.

HAIR TONIC.—Micheal J. Fleming, Portland, Oregon. This invention is for a compound to be applied to the scalp and rubbed in where the hair is thin or absent, to promote its restoration. Its ingredients include iron oxide, rum and bear's grease compounded and prepared in a manner specified.

CIGAR OR CIGARETTE HOLDER.—Arthur C. Morrison, Uniontown, Ky. This is a holder formed of a length of spring wire, so bent as to enable the smoker to readily clasp with it the cigar or cigarette, and hold the same with the finger of one hand, enabling the holder to otherwise have the use of both hands. The device is very light and inexpensive.

CIGARETTE BOX.—Howard Watkins, South Orange, N. J. This box is made in two sections, one received within the other, the inner section having a tongue with a notch in one side and the outer section having a slot receiving the tongue, with other novel details. The invention affords a cheap and superior box that may be produced from metal, pasteboard, vulcanite, or celluloid, etc.

PESSARY.—Newton E. Charlton, Trinidad, Col. This is a cup-shaped device having a thin bottom, an outer wall in which is an annular chamber, and a spring-pressed plug valve in the casing controlling a port leading from the chamber to the cup.

ANIMAL TRAP.—James M. Kellogg, Bozeman, Montana. This inventor has devised a trap especially designed for catching mice, rats, rabbits, etc., in large numbers, without requiring attention. It has a spring-pressed lifting wheel to automatically close the inlet doors, a releasing device for the wheel to permit the latter to close the doors, and an automatic resetting device to cause the wheel to open the doors. The animal, in passing from the entrance chamber from the cage, whence he cannot return, resets the trap.

LIQUID MEASURE DRAIN.—Samuel J. Wisdom, Montgomery, Ala. This is a receptacle adapted for attachment to the head or side of a barrel or like vessel, to support the measures used so that they will drain into the barrel or vessel, also preventing insects from getting into the measures. The receptacle has a contracted base, above which is a partition having slots, a wall of each slot being carried down below the partition to form a lip. The measures are at all times readily accessible, and the receptacle may be conveniently removed and cleaned.

Designs.

POCKET KNIFE HANDLE.—William Schmachtenberg, New York City. This design is for a metallic handle with dull finished faces and polished ends, the handle slightly tapering from the butt to the blade end, while the blade opening indentations are beveled and polished.

BOTTLE HOLDER.—Eugene L. Jacques, Waterbury, Conn. For holding ginger ale and similar bottles, this inventor has devised a block simulating ice, in the top surface of which are depressions of the general shape of the bottles.

SPOON HANDLE.—August Miller, Taunton, Mass. This handle is ornamented on its face with a central convex panel surrounded by a raised ornamental border broken into inturned scrolls, and its back has a concave central panel with corresponding ornaments.

ASH PAN.—Mary V. Conner, Tuskegee, Ala. This pan is higher at the back than at the front, is generally of pleasing contour, and has at its front a skeleton handle, whose side members continue oppositely across the bottom of the pan to its rear corners.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co. for 10 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

INORGANIC CHEMICAL PREPARATIONS. By Frank Hall Thorpe. Boston, U. S. A., and London: Ginn & Company, The Athenæum Press. 1896. Pp. iv, 238. Price $1.60.

This work, very well selected as regards its subject, touches on the preparation of the most generally used chemicals, from convenient sources. The idea is that a deficiency exists in the usual curriculum, wherein the student on entering the laboratory uses the chemicals supplied to him, takes his course in chemistry and graduates without knowing how a single one of the reagents is made. This deficiency in our present courses of instruction Dr. Thorpe aims to supply, and the work makes an admirable supplement to a chemical course. It is written by the instructor in industrial chemistry in the Massachusetts Institute of Technology. The book suggests a system which, if followed, would add to the value of any course in chemistry as given on the usual lines, for the work certainly covers ground which has hitherto been decidedly neglected in our technical schools.

THE CAMERA AND THE PEN. By T. C. Hepworth. London: Percy Lund, Humphries & Company, Limited. The Country Press, Bradford; and Amen Corner, Paternoster Row, London. Pp. 64. With illustrations.

This capital little work reviews photography from the aspect of the reporter, and gives largely a newspaper man's view of it. It is simply designed to elucidate the application of process and photographic work to the production of illustrations in newspapers, especially of such as are to be executed with the pen for reproduction. The work is not only practical but anecdotal as well, and forms quite good reading. It is well illustrated and the make-up of the book is quite attractive.

THE X RAYS. By Arthur Thornton. Bradford: Percy Lund & Company. London: Memorial Hall, Ludgate Circus. 1896. Pp. 63.

From these publishers we have a very pretty treatise on the X rays, constituting No. 10 of what the publishers term "The Popular Photographic Series." It is similar in style to Mr. Hepworth's book and contains numerous practical suggestions of value to the experimentalist.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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(7127) F. C. W. asks: 1. How many volts are required to run a motor, of one-twelfth to one-sixteenth horse power, wound for battery circuit? A. It depends on the winding of the motor. As it needs about 40 watts and a primary battery, current should be kept low, probably 20 volts would be a fair guess at the figure asked. 2. How many gravity cells would be required to run it? A. Several hundred. This class of cell is entirely unsuited for this work, unless you are willing to use a very large number. The use of such a number entails a great deal of labor in the care of them. 3. How many Leclanche cells would run it? A. The Leclanche cells are still worse. They cannot be used on closed circuit work except for exceedingly small currents. 4. Would this motor run an ordinary sewing machine? A. Yes. 5. Is the number of volts produced by a Leclanche carbon cylinder battery as great as that made on the principle of Sampson? A. They are about the same. 6. Would any power be obtained if above motor was converted into a dynamo? A. Probably very little. Small motors are not generally constructed so as to be available for generators. 7. Can you tell me if a small powder cannon can be fired by electricity, by means of a platinum wire? A. Yes; without difficulty. For other queries address our advertisers of electrical goods.

(7128) H. K. C. says: I am anxious to secure the formula for etching on steel plate or iron, and do not know where I can learn it, unless you will give it to me. If you will do this, I will be very much indebted to you. A. 1. Two ounces copper sulphate, alum ½ ounce, salt ½ ounce, mixed with ½ pint vinegar, and 40 drops nitric acid can be used for frosting the steel. 2. Glacial acetic acid, 4 parts; absolute alcohol, 1 part; nitric acid (s. g. 1·28), 1 part; allow the acetic acid and alcohol to remain for half hour, then add nitric acid carefully. Etch from one to fifteen minutes. 3. Alcohol, 3 parts; water (distilled), 5 parts; nitric acid, 8 parts; silver nitrate, 8 parts. Wash the plate with very dilute nitrate acid, then apply the solution for three minutes, and wash with 6 per cent solution of alcohol. Repeat if necessary. 4. (Delechamp's for vertical bite.) Silver acetate, 2 parts; rectified spirits, 125 parts; distilled water, 125 parts; nitric acid, 65 parts; nitric ether (see No. 5 of copper etching above), 16 parts; oxalic acid, 1 part. 5. Iodine, 4 parts; potassium iodide, 10 parts; water, 80 parts. This is very highly recommended.

(7129) F. C. G. asks: 1. Will the zincs and coppers in a gravity battery waste away if kept in the solution when the battery is on an open circuit? A. Yes; a small current will operate to prevent the deposition of copper on the zincs. 2. How is Faure's accumulator or secondary battery made? A. See our SUPPLEMENT, Nos. 322, 568 and 838. 3. How many quart gravity batteries should it take to run a telegraph line about ¼ mile long with 3 instruments of 20 ohms resistance each? Line with ground circuit. A. Allow ten cells for this work.

(7130) H. G. J. asks: 1. Can you talk over any line with an electric telephone that you can ring a magneto bell over? A. With proper telephone apparatus you can do this. The telephone should have an equal or greater range of action. 2. Has it ever been tried to use a barb wire fence for a telephone line? Would it be possible? A. This has often been done successfully. 3. Is there any cheap liquid insulator that can be put on the post that will harden? Am thinking of putting in a line from here to my ranch (ten miles); have a barb wire

fence all the way. Have no snow here and the atmosphere is very dry. A. We cannot recommend any insulator. Undoubtedly hot paraffine wax would be useful, but too expensive. We think that in your climate no insulator would be requisite.

(7131) M. J. S. asks: 1. What is the difference between high and low voltage lamps (incandescent)? Is it in size of carbon filament? A. The difference is in the resistance of the filament, and therefore in its cross section. They are designed to pass about 3 watts per candle power, and hence for higher voltages pass less current. 2. What would be a simple process for extracting gelatine from bones? Would it consist in pulverizing and boiling and then evaporating the solution as in making soup, or could not a chemical solvent, as HCl, be used to disintegrate the lime and so liberate the gelatine, or would this process render it unfit for cooking purposes? A. The hydrochloric acid treatment could be applied, but would involve difficulty in disposing of the excess of acid and salts and would involve expense. 3. What is meant by polarization of batteries? A. It means properly the accumulation of material, generally hydrogen, about the negative plate, so as to prevent generation of E. M. F. Exhaustion of the depolarizer is the cause, and really is a good expression for depolarization.

(7132) T. P. W. asks: Will you be so kind as to explain, if possible, for the benefit of one of your readers, the process by which a sheet of paper may be split so as to preserve both sides. For example: A page of a magazine has cuts on each side which it is desired to preserve so both can be mounted. A. The paper to be split is pasted between two sheets of compact strong paper. The best flour paste should be used. Mucilage is unreliable. When nearly dry, if the two outer pieces of paper are pulled apart, the central one will split, and one-half of the central piece will adhere to each. By soaking in water they can be removed. Some kinds of paper work better than others. If the outer paper is of a loose texture, it may split instead of the desired one. But the best plan is to paste a piece of cloth to each side of the sheet to be split. When dry, violently and without hesitation pull the two pieces asunder, when part of the sheet will be found to have adhered to one and part to the other. Soften the paste in water, and the pieces can be easily removed from the cloth. The process is generally demonstrated as a matter of curiosity, yet it can be utilized in various ways. If we want to paste in a scrap book a newspaper article printed on both sides of the paper, and possess only one copy, it is very convenient to know how to detach the one side from the other. The paper, when split, as may be imagined, is more transparent than it was before being subjected to the operation, and the printing ink is somewhat duller; otherwise the two pieces present the appearance of the original if again brought together.

(7133) L. A. McC. writes: 1. In the description you say that No. 18 (A. W. G.) soft iron wire should be used in the core of the armature and that No. 18 cotton covered copper magnet wire should be used in the coils of the armature and that No. 16 magnet wire should be used in the coils of the field magnet, and then in the dimensions of motor tabulated below you give No. 16 wire to be used for both armature and field coils. Please give me correct numbers of all. A. Use No. 18 copper wire (magnet wire) in armature winding; rest as given in article. 2. Is black adhesive tape, such as is used by line men, the proper tape for insulating the cores? A. Such tape as you specify is excellent for the purpose. 3. Should the cotton covered wire be single or double covered? Which is best? A. Use double covered wire. 4. Is there any soft iron wire used expressly for the purpose of making armature cores? If so, give name proper. Or would such wire as is used for bracing stovepipes up (which is an annealed wire and very soft and tough) be good, and is there anything particular about it not being a size or two larger? A. Stovepipe wire will answer every requirement for cores. The size is not very material; in general, the finer, the better. 5. Should the Russia iron in the core of field magnet be wound in continuous layers with ends abutted or should it be in separate layers? A. It is quite immaterial. Wind it as it comes, simply aiming at a neat shape.

(7134) L. D. asks: What size motor running to its full capacity will a storage battery run that has a capacity of ten volts and two and two-fifths amperes? A. Approximately, one-thirtieth horse power.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

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[See note at end of list about copies of these patents.]

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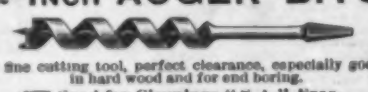

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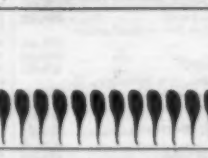

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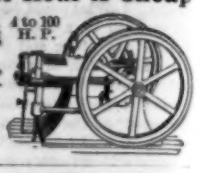

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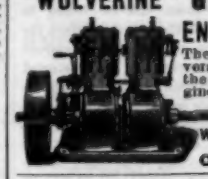

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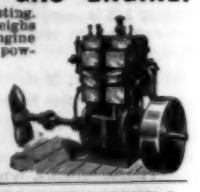

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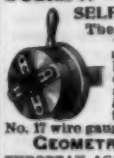

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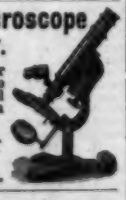

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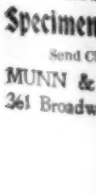

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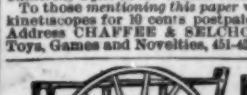

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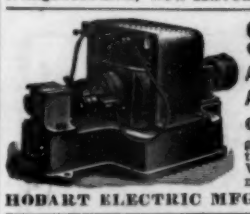

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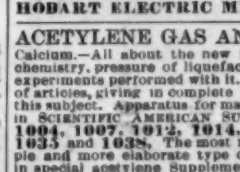

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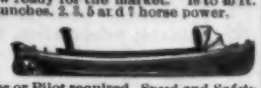

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